Appendix I

Essential Fish Habitat Assessment

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ESSENTIAL FISH HABITAT ASSESSMENT FOR THE PORT OF GULFPORT EXPANSION PROJECT HARRISON COUNTY, MISSISSIPPI

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Acronyms and Abbreviations

°F	degrees Fahrenheit
BA	Biological Assessment
BMC	Biloxi Marsh Complex – Northeastern Outlying Island
BU	Beneficial Use
BUG	Beneficial Use Group
CFR	*Code of Federal Regulations*
CIAP	Coastal Impact Assistance Program
CWA	Clean Water Act
cy	cubic yards
cSEL	cumulative sound exposure level
dB	Decibels
dBA	A-weighted decibels
DA	Department of the Army
DMMP	Dredged Material Management Plan
DO	dissolved oxygen
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FHWG	Fisheries Hydroacoustic Working Group
FMP	Fisheries Management Plan
FNC	Federal Navigation Channel
GIWW	Gulf Intracoastal Waterway
GMFMC	Gulf of Mexico Fisheries Management Council
Gulf	Gulf of Mexico
HAPC	Habitat Areas of Particular Concern
I-10	Interstate Highway I-10
mcy	million cubic yards
MDMR	Mississippi Department of Marine Resources
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
mg/L	milligrams per liter
MLLW	mean lower low water
MMNS	Mississippi Museum of Natural Sciences
MPRSA	Marine Protection, Research, and Sanctuaries Act
MsCIP	Mississippi Coastal Improvements Program
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
msl	Mean sea level
MSPA	Mississippi State Port Authority
NEPA	National Environmental Policy Act

NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWI	National Wetlands Inventory
ODMDS	Ocean Dredged Material Disposal Site
LPEAK	peak level sound measurement
PCB	polychlorinated biphenyls
PGEP	Port of Gulfport Expansion Project
Port	Port of Gulfport
ppt	parts per thousand
RMG	rail-mounted gantry
RMS	root mean square
su	standard units
TEU	twenty-foot equivalent unit
TNC	The Nature Conservancy
TSS	total suspended solids
U.S.	United States
US	U.S. Highway
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WRDA	Water Resources Development Act

1.0 INTRODUCTION

The Mississippi State Port Authority (MSPA) applied to U.S. Army Corps of Engineers (USACE), Mobile District, for a Department of the Army (DA) permit, under Section 10 of the Rivers and Harbors Act of 1899 (33 United States Code [USC] 403), Section 404 of the Clean Water Act (CWA) (33 USC 1344), and Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972, as amended (33 USC 1413) for activities related to the proposed expansion of the Port of Gulfport (Port). The proposed Port of Gulfport Expansion Project (PGEP or proposed Project) is located south of the City of Gulfport's urban center in Harrison County, Mississippi, within the city limits (Figure 1) and is approximately 7 miles south of Interstate 10 (I-10), 80 miles west of Mobile, Alabama, and 80 miles east of New Orleans, Louisiana. The Port encompasses approximately 369 acres and is located on the north shore of the Mississippi Sound within 5 miles of the Gulf Intracoastal Waterway (GIWW) and 10 miles from the Gulf of Mexico (Gulf) and the Gulf Island National Seashore.

The National Marine Fisheries Service (NMFS) requested (via letter dated May 11, 2010) an expanded Essential Fish Habitat (EFH) consultation pursuant to 50 *Code of Federal Regulations* (CFR) Section 600.920(i) based on the size of the proposed Project and potential impacts to EFH (Appendix A). This report presents an evaluation of potential EFH and fisheries within the Project area. For evaluating EFH, the Project area surrounding the Port is defined as the footprint of the Project features with a 5,000- foot buffer (Figure 2). The purpose of the investigation was to identify federally managed species protected under the 1996 Amendment to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) that might occur in the vicinity of the proposed Project. This EFH Assessment is included as part of the Environmental Impact Statement (EIS) for the proposed PGEP.

A benthic habitat assessment was conducted in response to agency concern for potential Project-related impacts to Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in April 2012 (Appendix G of the EIS). The purpose of the study was to characterize the benthic habitat and community substrate, seagrasses, macrobenthic organisms, and ambient water conditions within the proposed Project footprint, Project area, and larger study area (refer to Figure 3.0-1 in the EIS). In addition, a Gulf Sturgeon Monitoring Study was conducted from fall 2012 to fall 2014 (Peterson et al., 2015) (see Appendix O of the EIS). The purpose of this study was to monitor the area surrounding the Port and to determine the use of near shore areas within the proposed Project footprint by the Gulf sturgeon. Life history descriptions and potential impacts to the Gulf Sturgeon are discussed in the Biological Assessment (BA) prepared for the EIS (Appendix J of the EIS). Data from these reports were used in this EFH Assessment to describe potential adverse impacts from the PGEP.

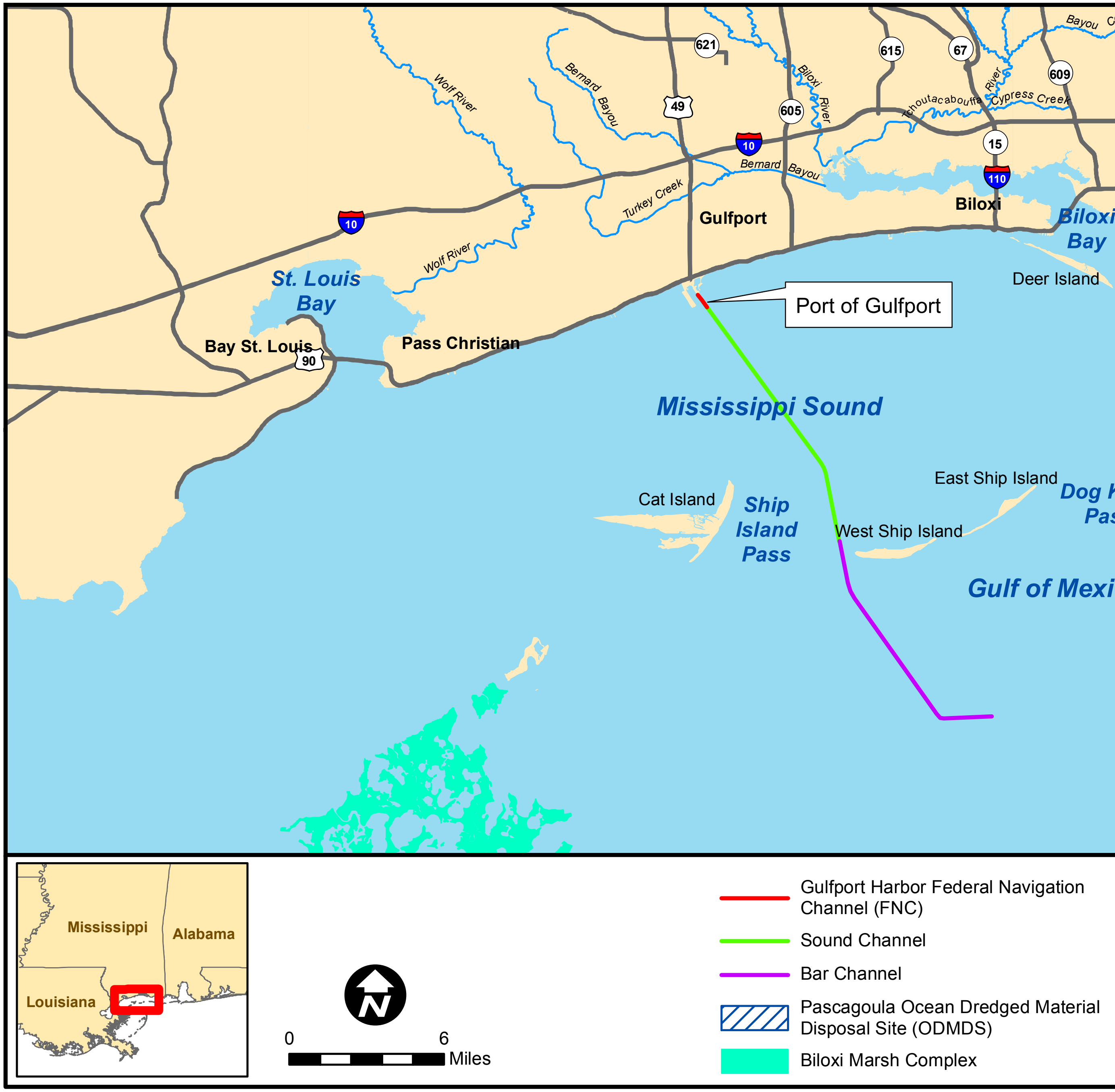

Figure 1

Port of Gulfport Expansion Project

Location Map

Prepared By: 19910	Scale: 1" = 6 miles
Job No.: 100018536	Date: September 25, 2015

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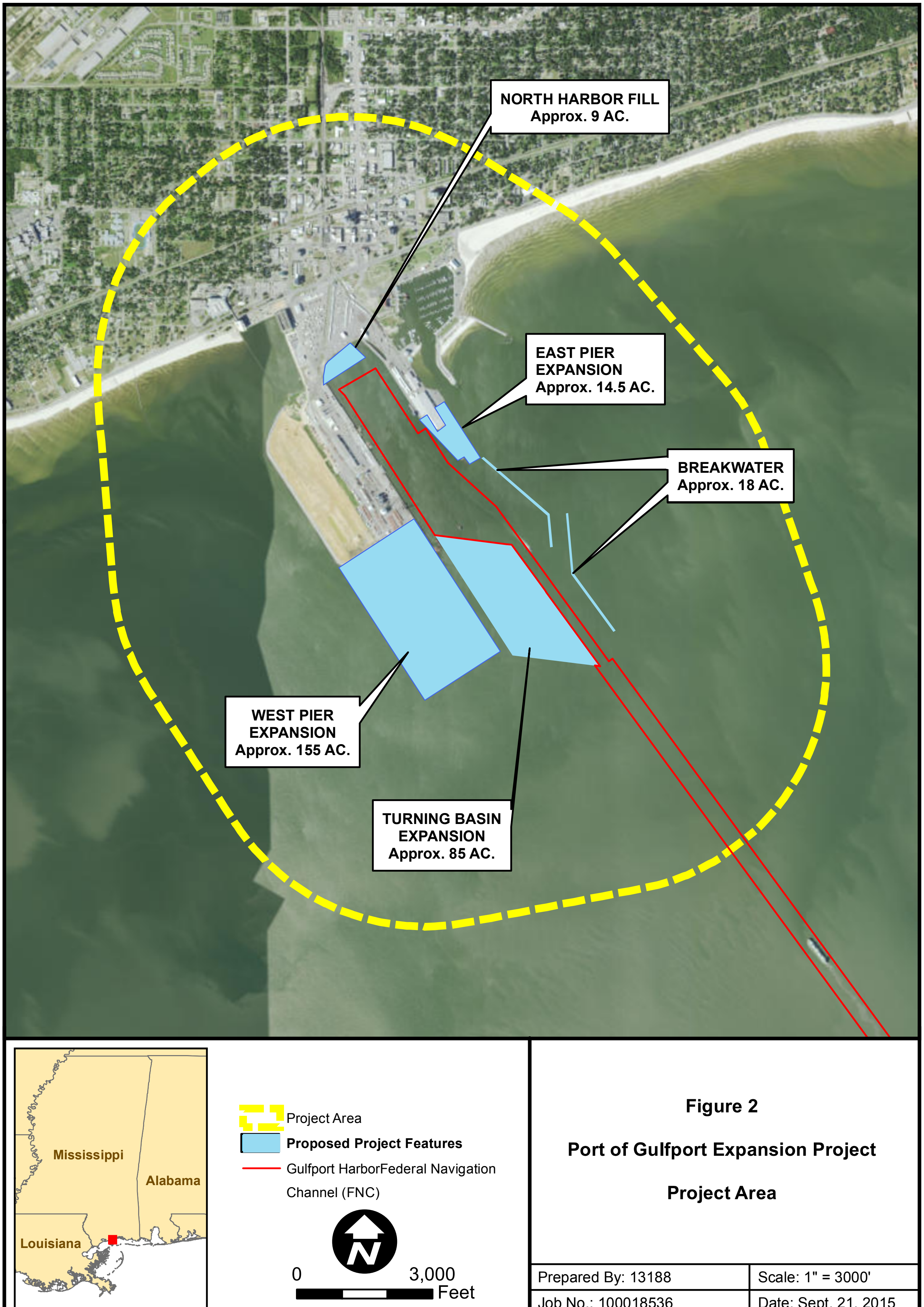

Figure 2

Port of Gulfport Expansion Project

Project Area

Prepared By: 13188	Scale: 1" = 3000'
Job No.: 100018536	Date: Sept. 21, 2015

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1.1 ROLE OF NATIONAL MARINE FISHERIES SERVICE IN ESSENTIAL FISH HABITAT CONSULTATION

The MSFCMA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The definition for EFH may include habitat for an individual species or a group of species, whichever is appropriate within each Fisheries Management Plan (FMP). EFH is separated into estuarine and marine components. The estuarine component is defined as "all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities); subtidal vegetation (seagrasses and algae); and adjacent intertidal vegetation (marshes and mangroves)." The marine component is defined as "all marine waters and substrates (mud, sand, shell, rock, and associated biological communities) from the shoreline to the seaward limit of the Exclusive Economic Zone" (Gulf of Mexico Fisheries Management Council [GMFMC], 2004). Adverse effect to EFH is defined as, "any impact, which reduces quality and/or quantity of EFH…" and may include direct, indirect, site specific or habitat impacts, including individual, cumulative, or synergistic consequences of actions.

Congress enacted amendments to the MSFCMA (PL 94-265) in 1996 that established procedures for identifying EFH and required interagency coordination to further the conservation of federally managed fisheries. Rules published by NMFS (50 CFR Sections 600.805–600.930) specify that any Federal agency that authorizes, funds, or undertakes or proposes to authorize, fund, or undertake, an activity that could adversely affect EFH is subject to the consultation provisions of the MSFCMA and identifies consultation requirements. The NMFS provided initial comments to USACE in letters dated May 11 and June 3, 2014. This EFH Assessment addresses those comments, and the EIS serves to further consultation with the NMFS.

1.2 PROJECT DESCRIPTION

The MSPA applied to the USACE, Mobile District, on March 9, 2010, for a DA permit, under Section 404 of the CWA, Section 103 of the MPRSA, and Section 10 of the Rivers and Harbors Act for activities subject to USACE jurisdiction that include filling estuarine mud and sand bottom habitat in Mississippi Sound, dredging in navigable waters to expand the Gulfport Turning Basin (located outside the federally authorized Project), and placement of dredged material to fill "waters of the United States (U.S.)." Then in April 2013, the MSPA requested that the proposed Project be modified to include widening and deepening of the existing Gulfport Harbor Federal Navigation Channel (FNC), and submitted a revised permit application to include modifications to the FNC. The Project has changed since 2013, and as of February 2015, MSPA does not intend to expand or maintain an expanded FNC as part of the proposed expansion of the Port without first receiving funding and prior Federal approval through the Water Resources Development Act (WRDA) 204(f) process. As such, the current proposed action being evaluated for a DA permit is expansion of the Port via modifications to the West Pier, East Pier, North Harbor, and Turning Basin, and includes construction of a breakwater on the eastern side of the FNC. Based on the DA permit application submitted by MSPA, USACE determined that the permitting action for the proposed dredge and fill activities constitutes a major Federal action with potentially significant effects and/or substantial public interest. In accordance with the National Environmental Policy Act (NEPA), this EFH Assessment is part of the EIS and has been prepared to analyze and disclose the potential impacts of the proposed Project on EFH.

1.3 PROJECT AREA AND EXISTING PORT FACILITY

The Port encompasses approximately 369 acres and is located on north shore of the Mississippi Sound within 5 miles of the GIWW and 10 miles from the Gulf and Gulf Island National Seashore (Figure 1). The Port is constructed on fill over former Mississippi Sound bottoms and includes the East Pier, North Harbor, West Pier, and Commercial Small Craft Harbor. Access to the Port is via the FNC and a Commercial Small Craft Channel (8 feet deep). Located to the east of the Port are the Gulfport Small Craft Harbor, Gulfport Yacht Club, Harbor Square Park, and U.S. Coast Guard (USCG) Station Gulfport. Public beaches are located to the east and west of, and adjacent to, the Port. The northern boundary of the Port is U.S. Highway (US) 90.

The FNC is 300 feet wide in the inner channel (Sound Channel) and maintained to a depth of 36 feet within Mississippi Sound. The outer channel (Bar Channel) from Ship Island south to the safety fairway is 400 feet wide with a depth of 38 feet. The Port's North Harbor (Inner Harbor) is maintained to a depth of 32 feet, while the South Harbor (Outer Harbor) and Gulfport Turning Basin, which are approximately 1,320 feet wide, are maintained to a depth of 36 feet (USACE, 2009). The depths provided do not include 2 feet of allowable over depth and 2 feet of advance maintenance.

1.4 ALTERNATIVES

The proposed PGEP involves the dredging and filling of approximately 282 acres of estuarine mud and sand bottom habitat in Mississippi Sound for the construction of wharfs, bulkheads, terminal facilities, container storage areas, intermodal container transfer facilities, expanded turning basin, and construction of an approximately 4,000-linear foot breakwater, in addition to the placement of new work and maintenance dredged material, refer to Table 1. Of the 282 acres potentially impacted by the proposed Project, approximately 85.5 acres will become deeper open water habitat. The proposed expanded Port facility would be elevated to up to +25 feet mean sea level (msl) to provide protection against future storm surge events.

During the preparation of the proposed EIS, several reasonable and practicable alternatives for the expansion of the Port facility were considered. The Proposed Project Alternative was selected as the smallest footprint that would reduce the ecological impact of proposed Project activities, while allowing the Port to achieve an increase in its economic throughput. The following sections describe the ecological and economic outcomes expected to occur should no construction requiring a USACE permit be performed (No-Action Alternative) or the USACE, Mobile District, approves the requested permit for the proposed Project (Proposed Project Alternative).

Table 1
Proposed Project Alternative, Direct Impact Estimates

Feature	Estimated Acreage Impact (acres)	Estimated Dredged Material Volume (million cubic yards)
West Pier Expansion	155	2.40
East Pier Expansion	15	0.56*
North Harbor Expansion	9	0.84
Breakwater	18	0
Turning Basin Expansion	85	3.70
Totals	282	7.5*

*560,000 cubic yards (cy) of dredged material is designated for upland disposal.

1.4.1 No-Action Alternative

The No-Action Alternative provides a means to evaluate the environmental impacts that would occur if no construction requiring a USACE permit is performed; work that does not require a USACE permit may be implemented. This scenario may transpire by (1) the applicant electing to modify his proposal to eliminate work under the jurisdiction of the USACE, or (2) by the denial of the USACE permit for the proposed expansion of the Port facilities. Since the PGEP requires dredging activities in navigable waters subject to Section 10 of the Rivers and Harbors Act and fill activities subject to Section 404 of the CWA and Section 103 of the MPRSA, construction activities involving dredge and fill would not proceed without a permit from the USACE. In the event of permit denial, the potential impacts described for the proposed action would not occur.

While the PGEP would not occur under the No-Action Alternative, it is assumed that previously permitted actions at the Port and in the vicinity of the Port (e.g., Restoration Project) would continue and are assumed as complete during the environmental consequences evaluation of the EIS. The No-Action Alternative assumes the Restoration Project has been completed (see Section 1.3.1 of the EIS); thus, future projected conditions from approved NEPA documentation will be used to aid in the description of future conditions under the No-Action Alternative, as appropriate.

1.4.2 Proposed Project Alternative

The expansion and modification of the Port facility under the Proposed Project Alternative would be configured and automated as described below. The main features of this alternative include:

- Expansion of the West Pier
- Expansion of the East Pier
- Fill in the North Harbor
- Expansion of the federally authorized Turning Basin (at 36-foot depth)

- An eastern breakwater
- Placement of dredged material
- Site configuration and automation

As noted for the No-Action Alternative, the Proposed Project Alternative assumes that the Restoration Project has been completed. The Proposed Project Alternative features would be added to the post-Restoration Project footprint, with a few exceptions as discussed below (Table 2).

The proposed expansion features (not including the post-Restoration Project footprint) would be elevated to up to +25 feet msl to provide protection against future tropical storm surge events. The post-Restoration Project footprint would be elevated to up to +14 feet msl, with the proposed expansion footprint elevated to up to +25 feet msl. Each feature of the proposed expansion footprint is provided in Table 2. Fill material would be obtained from permitted sites located in coastal counties of Mississippi or from sources along the Tennessee-Tombigbee River.

Table 2
Port Footprint Following Proposed PGEP, Including
the Turning Basin Area (approximate acres)

Feature	Post-Restoration Footprint	Proposed Expansion Footprint	Total Footprint
West Pier	171	155	326
East Pier	30	14.5	44.5
North Harbor	63	9	72
Turning Basin	105	85	190
Breakwater	N/A	18	18
Total Footprint	369	281.5	650.5

West Pier Expansion

The West Pier Expansion is intended for development of a new concession area consisting of new, multiuse semi-automated container terminals. The proposed concession area would extend to the south of the West Pier footprint approximately 3,600 linear feet, adding approximately 155 acres to the existing facility. Prior to construction, the expansion footprint may require dredging for removal of soft to very soft foundation materials and to mitigate mud waves outside of the Project footprint. The estimated volume of dredged material is 2.4 million cubic yards (mcy) (Anchor QEA LLC, 2015, Appendix E of the EIS).

East Pier Expansion

The East Pier Expansion would add approximately 14.5 acres to the working surface of the Port's existing East Pier facility. This area would be used for rail operations and a new berth, and would provide additional space for McDermott. Similar to the West Pier Expansion, this area may require dredging prior to construction. The estimated volume of dredged material is 560,000 cy, which is generally debris that would be disposed in permitted and approved upland disposal areas (Anchor QEA LLC, 2015, Appendix E of the EIS).

North Harbor Expansion

The North Harbor Expansion would create approximately 9 acres of upland in the area formerly occupied by the *Copa Casino* boat. This upland area would be used as a new berthing area. Both new work dredging associated with the construction of this berth and future maintenance dredging would be required in this area (Anchor QEA LLC, 2015, Appendix E of the EIS).

Turning Basin Expansion

The existing Gulfport Turning Basin would be expanded to support the West Pier Expansion. The proposed Turning Basin Expansion (approximately 85 acres) would be between the existing Sound Channel and the proposed terminal, immediately adjacent to the Gulfport Turning Basin. This area would be dredged to a depth of –36-foot mean lower low water (MLLW) plus 2 feet of advance maintenance, plus 2 feet of allowable overdepth, and up to 3 feet due to a sediment disturbance layer consistent with the adjacent FNC and USACE maintenance dredging practices (Anchor QEA LLC, 2015, Appendix E of the EIS). The estimated volume of dredged material is 3.7 mcy.

Eastern Breakwater

A 4,000-linear-foot rip-rap breakwater is proposed on the eastern side of the FNC to provide protection from tropical storm events. The breakwater would vary from 98 to 102 feet wide at its base with a top width of 10 feet and a top elevation of +10 feet NAVD 88. The proposed breakwater would require placing approximately 250,000 cy of rip-rap over a footprint of approximately 18 acres. Baker (2011) evaluated four breakwater alternatives for the PGEP to determine the need to protect the expanded West Pier under storm conditions. Numerical modeling was used to recommend alternatives that would provide protection to the turning basin and terminals while maintaining operational and navigational utility. Modeling indicated that wave action would impact the expanded West Pier compared with current conditions and a need for a breakwater could not be ruled out. The Proposed Project Alternative provides protection from wave energy from the south and east. A breach midway along the alignment of the structure is planned to allow shallow-draft access to the FNC from the adjacent Bert Jones Marina and at the recommendation of the pilots performing ship simulations.

Dredged Material Placement

The new work dredging associated with the construction of the proposed West Pier and East Pier expansions, North Harbor and West Pier berthing areas, and the Turning Basin Expansion is estimated to require removal of approximately 7.5 mcy of dredged material, including 560,000 cy of dredged material (debris from East Pier) that would be designated for upland disposal. Following construction of the Turning Basin Expansion, the MSPA would be responsible for maintenance dredging of the portion of the new turning basin that is not part of the federally authorized project, as well as the berthing areas associated with the expanded East Pier, North Harbor, and West Pier. Maintenance dredging associated with these areas is anticipated to require removal of approximately 313,000 cy to 1.3 mcy every year. A Dredged Material Management Plan (DMMP) was prepared to evaluate the potential placement options for the new work and maintenance dredged material associated with the Proposed Project Alternative (Anchor QEA LLC, 2015, Appendix E of the EIS). Estimated dredged material quantities are shown in Table 3. Estimated dredge quantities assume maintenance for a 30-year period. At this time, it is expected that new work dredging would occur using mechanical/hopper dredge and maintenance dredging would occur using hydraulic/cutterhead or mechanical/hopper dredging, as necessary.

Table 3
Estimated Dredge Material Quantities, Proposed Project Alternative

Feature	West Pier Expansion	East Pier and East Pier Berthing Areas	North Harbor and West Pier Berthing Areas	Turning Basin Expansion	Total
New Work	2.4 mcy		845,000 cy	3.7 mcy	6.94 mcy
New Work (upland disposal)		560,000 cy			560,000 cy
Maintenance	N/A	63,000–172,000 cy/year	39,000–581,000 cy/year	211,000–586,000 cy/year	313,000 cy–1.3 mcy/year

Source: Anchor QEA LLC (2015)
cy – cubic yards
mcy – million cubic yards

The DMMP evaluated multiple placement alternatives for new work and maintenance dredged material. Sites considered for placement of dredged material included:

- Use as fill for the West Pier Expansion
- 12 designated Beneficial Use (BU) sites
- Thin layer placement
- Candidate BU sites
- Placement in an approved Ocean Dredged Material Disposal Site (ODMDS)

All sites were evaluated based on feasibility, potential environmental impacts, cost, and suitability of material. Potential beneficial use sites were evaluated based on capacity and distance to the dredge site, taking into consideration habitat value, stability, and sediment transport. Recommendations were made for each option (Anchor QEA LLC, 2015, Appendix E of the EIS). Considering additional information is needed to finalize the recommendations of dredged material placement alternatives, the following summarizes potential placement options.

New work dredged material structurally suitable would be used for fill at the Project site. Any material not structurally suitable would be evaluated for potential beneficial use and possible placement at a designated or candidate BU site. The Mississippi Department of Marine Resources (MDMR) is pursuing a permit to designate an area in the Biloxi Marsh Complex (BMC) in Louisiana for beneficial use of dredged material. The goal of this designation is to provide a new BU site on the western side of the state to accommodate material generated from private and public dredging projects to meet the requirements of Mississippi's beneficial use law.

During the DMMP evaluation, the Port began discussions with the MDMR/USACE Beneficial Use Group (BUG) on using the BMC as a placement area for suitable dredged material from the Port (see Figure 1). For the proposed PGEP, the BUG was in favor of a BU site instead of an ODMDS. As such, the BMC is the recommended placement alternative for the new work dredged material for the proposed Project (Anchor QEA LLC, 2015, Appendix E of the EIS). If a suitable site is identified, appropriate coordination would occur in the future. The BMC BU site would function to provide needed particulate material for shoreline nourishment and as protection from shoreline erosion on the Mississippi and Louisiana coasts. If the BMC is not permitted prior to dredging, and no other suitable BU sites are available, the Pascagoula ODMDS (see Figure 1) would be used for disposal of new work dredged material if the material is determined to be in compliance with Section 103 of the MPRSA (33 USC 1413). New work, dredged material not suitable for beneficial use would also be placed in the Pascagoula ODMDS if it meets the criteria in Section 103 of the MPRSA. If the dredged material is not suitable for the ODMDS, the material would be placed in an approved and permitted upland disposal site(s). The Port would be responsible for maintenance dredging of those areas outside of Federal jurisdiction. Maintenance dredged material will be disposed of as discussed in the DMMP (Anchor QEA LLC, 2015, Appendix E of the EIS).

Site Configuration/Automation

The PGEP would further develop the Port into a semi-automated container terminal. The Port has added three rail-mounted gantry (RMG) cranes to Port operations. The road and rail access constructed for the Restoration Project would be extended south on the western side of the West Pier along the expansion footprint. The gantry crane rail would be extended south on the eastern side of the West Pier along the expansion footprint. New infrastructure would include a new wharf, backlands, gates, and an additional warehouse. The new terminal would increase throughput by reducing handling times, allowing ships to come into the Port, unload, reload, and depart in a day or less. The proposed layout assumes that all berths would be utilized as common berths, and the berthing of a vessel would be based on berth availability, vessel schedule, and tenant needs. With the semi-automated operation of the container terminal via RMG cranes, refrigerated containers would be grounded within the RMG container blocks and placed four containers high and nine containers wide per row. This layout would require reefer racks (three-story steel platforms) in front of each row for mechanics to access containers, plug into reefer receptacles, and perform monitoring, inspection, and pretripping of refrigerated equipment. Loading and unloading of containers would be performed by utilizing the two RMGs to transfer containers between trackside ground positions and railcar well positions. The operation of the West Pier and the Turning Basin Expansion areas would include shared facilities, berths, backlands, and utilization of RMG cranes. With this layout, throughput capacity is projected to reach up to 1.7 million twenty-foot equivalent units (TEUs) annually by 2060.

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2.0 EXISTING ENVIRONMENT

For the discussion of the existing environment, habitat types are described within the Project area (see Figure 2). The evaluation of potential EFH and fisheries resource impacts focuses on the Proposed Project Alternative (see Figure 2). The following sections describe EFH in and adjacent to the Project area.

2.1 HABITAT/COMMUNITY TYPES

Ecoregions are typically considered large geographic areas that are easily distinguished from adjacent regions by differing biotic and environmental factors or ecological processes. Fundamental differences among ecoregions often include changes in climate, physical geography, soils, and large-scale vegetative structure and composition. The Project area is located within the East Gulf Coastal Plain ecoregion, as defined by The Nature Conservancy (TNC) and utilized by the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) (TNC, 1999; Mississippi Museum of Natural Science [MMNS], 2005), and includes the offshore areas of the Mississippi Sound and the Gulf. The Project area occurs at or near sea level, within the Estuary and Mississippi Sound wildlife habitat types, and the Mississippi Sound (smooth bottom) subtype. Mississippi Sound is an estuarine/marine lagoon system that occurs inside, or associated with, the barrier island complex (MMNS, 2005). According to the MDWFP, most of the area immediately adjacent to the existing Port facility is considered urban and suburban land; most of the area exhibits impervious cover, such as concrete or paving, or is heavily impacted by construction activities. As a result, minimal terrestrial vegetation occurs within the proposed Project area, particularly areas within the Project footprint.

Coastal habitat subtypes in the vicinity of the Project area include estuarine bays, lakes, tidal reefs, estuarine marshes, salt pannes, shell middens, estuarine shrublands, and maritime woodlands to the north, along interior protected shorelines and farther inland. Seagrasses and mollusk reefs occur along the interior margin of Mississippi Sound. Manmade beaches and mainland natural beaches occur along the coastline. Barrier island beaches, barrier island passes, barrier island uplands, and barrier island wetland habitats occur south of the Project area along the barrier islands (MMNS, 2005).

A benthic habitat assessment was conducted to satisfy NMFS concern for potential Project-related impacts to the Gulf sturgeon and EFH (see Appendix G of the EIS). This habitat assessment included a benthic habitat characterization of benthic samples collected from 48 locations within the Project footprint, Project area, and larger study area. Benthic organisms were dominated by polychaetes, with *Leitoscoloplos fragilis* and *Mediomastus ambiseta*, representing the most abundant organisms collected (see Appendix G of the EIS). Ross et al. (2009) recorded the same two species, but they were much less abundant. The macrobenthic samples by Ross et al. (2009) were dominated by Florida lancelets (*Branchiostoma floridae*), sand dollars (*Mellita quinquiesperforata*), amphipods, and bivalves (see Appendix G of the EIS).

Several trends were shown in comparing the Project footprint, the Project area, and the larger study area. The Project footprint and Project area had similar relative abundance, species diversity, and species richness with a slightly more even distribution of species. In comparison, the study area had greater species diversity than the Project footprint and Project area. It is possible that existing operations of the Port facilities, such as routine maintenance dredging and placement activities, may have an effect on the ambient conditions surrounding the facility (see Appendix G of the EIS).

2.2 ESSENTIAL FISH HABITAT CATEGORIES

The categories of EFH that occur within the Project area include the estuarine water column and estuarine mud and sand bottoms (unvegetated estuarine benthic habitats). Additionally, EFH located adjacent to the Project area includes estuarine emergent marsh, seagrasses, oyster reefs, and artificial reefs. Upland habitats, as well as fresh water habitats that are not connected to tidal waters or are not tidally influenced, were not considered EFH categories. A brief description of each community is provided below.

Estuarine water column: Habitats within the estuarine water column can be defined in terms of gradients and fluctuations in temperature, salinity, dissolved oxygen, turbidity, and nutrient supply. These components of the water column are variable in both time and space due to tidal fluctuations, freshwater inflows, and strong wind events. The estuarine water column serves as EFH by providing habitat for spawning, breeding, feeding, and growth for a broad array of species and life stages within species. Furthermore, the estuarine open water column serves as a transport medium for organisms between the ocean, upstream rivers, and freshwater systems, where species-specific habitat components are favorable for completing particular life-stages. Zooplankton and phytoplankton are the dominant organisms in this habitat and serve as the foundation of the estuarine and marine food webs.

Phytoplankton (microscopic algae) are the major primary producers (plant life) in the open bay, taking up carbon through photosynthesis and nutrients for growth. Phytoplankton are fed upon by zooplankton (such as small crustaceans, mollusks, and annelid worms), fish, and benthic consumers. In the Mississippi Sound, phytoplankton species composition changes seasonally but are generally dominated by diatoms. Phytoplankton densities are highest in the winter and lowest in the summer (Molina and Redalje, 2010).

Zooplankton are important because they graze on phytoplankton and are food for larval and juvenile fish, including the federally threatened Gulf sturgeon. Zooplankton are most abundant during the spring, with the minimum concentrations occurring in the fall. Zooplankton are limited by sediment turbidity (which limits the phytoplankton production) and currents that can flush them from phytoplankton-rich estuaries (Valiela, 1995). Nekton (organisms that swim freely in the water column) consist mainly of secondary consumers that feed on zooplankton or smaller nekton.

Mississippi Sound supports a diverse nekton community that includes fish, shrimp, and crabs. There are at least 152 fish species that include both resident and migratory species (Rakocinski et al., 1996). Common species of the Mississippi Sound are Atlantic croaker (*Micropogonias undulatus*), speckled worm eel (*Myrophus punctatus*), and southern flounder (*Paralichthys lethostigma*). Species composition changes with the seasons, with a continual turnover of peak abundances of species (Rakocinski et al., 1996).

Estuarine mud and sand bottoms: Estuarine bays are typically large, protected, low-energy, subtidal areas that are enclosed by land on three sides. Bays in Mississippi are up to 30 feet deep and substrates consist of a mixture of mud and sand. Salinity levels and turbidity change frequently depending on tidal variation and weather systems. The muddy bottoms often support a diversity of benthic life forms; including polychaetes, mollusks, insects, and crustaceans, while offering foraging opportunities for numerous bird species (MDMR, 1999). The Mississippi Sound bottom includes mud, fine to coarse sand, and shell fragments that contribute large quantities of nutrients and food.

The distribution of benthic macroinvertebrates is primarily influenced by bathymetry and sediment type (Calnan et al., 1989). Studies of the Mississippi Sound found that polychaetes, bivalves, gastropods, ribbon worms (*Menertea* sp.), and crustaceans are the most common benthic organisms (see Appendix G of the EIS; Ross et al., 2009; Wilber et al., 2006; Environmental Protection Administration [EPA], 2011). Benthic organisms are divided into two groups: epifauna, such as crabs and smaller crustaceans, which live on the surface of the bottom substrate, and infauna, such as mollusks and polychaetes, which burrow into the bottom substrate (Green et al., 1992). Mollusks and some other infaunal organisms are filter feeders that strain suspended particles from the water column; whereas, other organisms, such as polychaetes, feed by ingesting sediments and extracting nutrients. Many of the epifauna and infauna feed on plankton, and in turn, are then fed upon by numerous fish and birds (Armstrong et al., 1987; Lester and Gonzales, 2001).

Table 4 presents the representative benthic macroinvertebrate species that occur in the study area (see Appendix G of the EIS). The data in the table are separated into three general habitat types—nearshore, mid-shore, and passes. Nearshore habitat is dominated by mud/clay substrate and is located between 0 to 3 miles from shore. Mid-shore habitat has some mud, but also has various grain sizes of sand and is located between 3 to 6 miles from shore. The passes are characterized by mostly medium to coarse sand and are located 6 to 12 miles from shore.

Table 4
Representative Benthic Macroinvertebrates that
Occur in the Study Area*

Scientific Name	Common Name	Description
Nearshore (within 3 miles of the shoreline):		
Ogyrides alphaerostris	Estuarine long eyed shrimp	Crustacean
Paraprionospio pinnata	Pinnated spionid pinnata	Polychaete worm
Phoronis spp.	Phoronids	Horseshoe worms (filter feeding lophophore)
Pinnixa spp.	Gulfweed crab	Decapod crustacean
Prionospio perkinsi	No common name	Polychaete worm
Parandalia americana	No common name	Polychaete worm
Polydora	Mud worm	Polychaete worm
Mid-shore (3 to 6 miles from shore):		
Cossura delta	No common name	Polychaete worm
Acanthohaustorius sp.	No common name	Amphipod
Acteocina canaliculata	Channeled barrel-bubble	Gastropod
Edwardsia	Ivell’s sea anemone	Sea anemone
Passes (approximately 6 to 12 miles from shore):		
Cyclaspis varians	No common name	Crustacean
Brania wellfleetensis	No common name	Polychaete worm
Chione cancellata	No common name	Bivalve (clam)
Ancistrosyllis sp.	No common name	Polychaete worm
Mediomastus sp.	No common name	Polychaete worm
Unid. Ophiuroidea	No common name	Brittle star

Source: EPA (2011).
*Common names and groups are according to *World Register of Marine Species* (2011).

The Mississippi Sound consists of 25 percent nearshore habitat that is less than 7 feet deep and 75 percent offshore habitat (MMNS, 2005). The medium to coarse sand in the Mississippi Sound is populated with macrobenthic organisms (Ross et al., 2009). Bivalves in estuarine sand bottoms include the blood ark (*Anadara ovalis*), incongruous ark (*Anadara brasiliana*), southern quahog (*Mercenaria campechiensis*), giant cockle (*Dinocardium robustum*), disk dosini (*Dosinia discus*), pen shells (*Atrina serrata*), common egg cockle (*Laevicardium laevigatum*), crossbarred venus (*Chione cancellata*), tellins (*Tellina* spp.), and the tusk shell (*Dentalium texasianum*). One of the most common species occurring in the shallow offshore sands is the sand dollar (*Mellit quinquiesperforata*), as well as several species of brittle stars (*Hemipholis elongata*, *Ophiolepis elegans*, and *Ophiothrix angulata*). Many gastropods are common, including the moon snail (*Polinices duplicatus*), ear snail (*Sinum perspectivum*), Atlantic auger (*Terebra dislocata*), Salle’s auger (*Terebra salleano*), scotch bonnet (*Phalium granulatum*), distroted triton (*Distrosio clathrata*), wentletraps (*Epitonium* sp.), and whelks (*Busycon* spp.). Common crustaceans include white shrimp (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*) (both are commercially important), rock shrimp (*Sicyonia brevirostris*), blue crabs (*Callinectes sapidus*), mole crabs (*Albunea* spp.), speckled crab (*Arenaeus cribrarius*), box crab (*Calappa sulcata*), calico crab (*Hepatus epheliticus*), and pea crab (*Pinotheres maculatus*). The most abundant infaunal organisms, with respect to the number of individuals, are the polychaetes (Capitellidae, Orbiniidae, Magelonidae, and Paraonidae) (Britton and Morton, 1989). Approximately 4,061 acres of estuarine mud and sand bottom occur with the Project area.

Estuarine emergent marsh: Estuarine marshes consist of intertidal salt, brackish, and tidal freshwater marshes, which provide fringe habitats along the coast, barrier islands, and the mouths of streams and bays (Gosselink, 1984). Tidal marshes typically consist of organic substrates comingled with mineral horizons that were likely deposited during storm surges. Saltmarshes are at low elevations within the tidal zone and are exposed to higher salinities. Saltmarsh vegetation varies depending on the elevation and proximity (zones) to open-water habitat. Lower zones at or below sea level are dominated by smooth cordgrass (*Spartina alterniflora*) communities, which are positioned along exposed shorelines and outer sections of tidal creeks and bays (MDMR, 1999). Marsh communities farther inland, located above the mean high-water mark of the tidal zone, flood irregularly and are typically dominated by black needlerush (*Juncus roemerianus*). Brackish marshes are less affected by storm surges and have lower salinity, thereby allowing for the development of a greater diversity of plant species.

Most estuarine emergent marshes proximal to the Project area occur within estuaries of St. Louis Bay and Biloxi Bay and are mapped as estuarine emergent and estuarine scrub-shrub (U.S. Fish and Wildlife Service [USFWS], 2011). No estuarine emergent marsh EFH occurs within the Project area (Figure 3).

Seagrass: Seagrasses, a type of submerged aquatic vegetation (SAV), are a unique group of vascular plants that have adapted to live in shallow coastal marine waters. Coastal seagrass beds are highly productive compared to other ecosystems, perform a number of vital ecological functions in chemical cycling and physical modification of the water column and sediments, and provide food and shelter for commercially and ecologically important organisms (Orth et al., 2006).

In Mississippi Sound, seagrasses have historically been declining. Forty years ago, an estimated 20,000 acres of seagrasses were documented in Mississippi Sound, and by 1998, only 2,000 acres remained (Moncreiff et al., 1998; Handley et al., 2007). Declines in seagrasses result from both natural and anthropogenic causes. Primary reasons for the disappearance of seagrasses are most likely an overall decline in water quality, extended periods of depressed salinities, and physical disturbances, such as tropical storms and hurricanes. Physical loss of habitat and decreased light availability, coupled with declining water quality, are the most visible features that directly affect seagrasses (USACE, 2009).

Barrier island seagrass communities historically hosted four species of seagrasses: shoalgrass (*Halodule wrightii*), turtlegrass (*Thalassia testudinum*), clovergrass (*Halophila engelmannia*), and manateegrass (*Syringodium filiforme*); however, the extent of these communities, as well as particular species, has

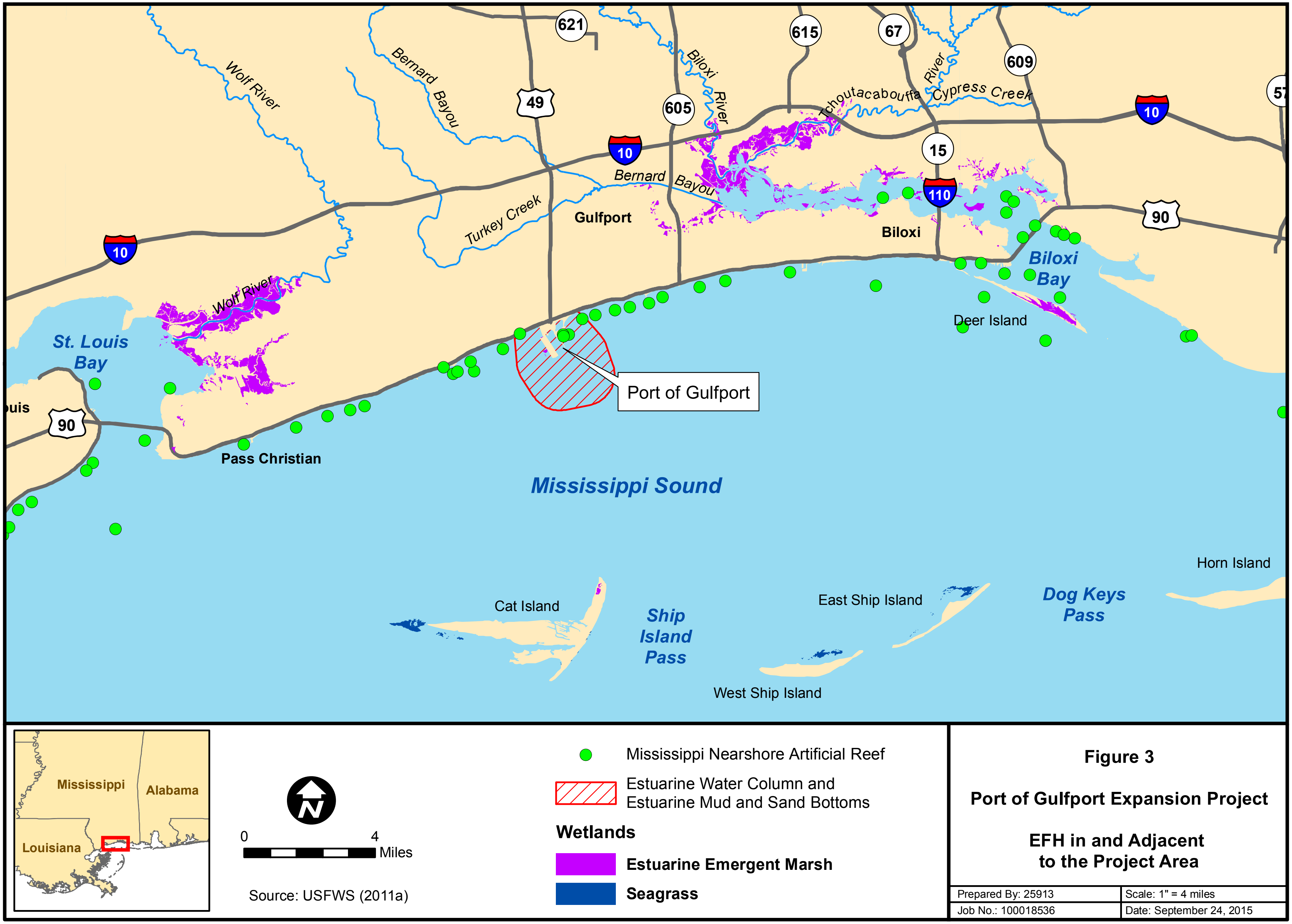

Figure 3

Port of Gulfport Expansion Project

EFH in and Adjacent to the Project Area

declined considerably in recent decades (MDMR, 1999). Widgeongrass (*Ruppia maritima*) beds occur in shallow and moderately turbid waters lower in salinity, such as bays, bayous, mudflats, and occasionally in barrier island ponds. Seagrass beds typically occur in less turbid, moderately saline habitats of the nearshore zone, north of the barrier islands. Currently, seagrasses are sparse in the Mississippi Sound region. However, based on a recent report prepared for the Mississippi Coastal Improvements Program (MsCIP) Barrier Island Restoration Project (Ship Island and Cat Island), the acreage of mapped SAV in Mississippi Sound has increased slightly from 3,614 acres in 2010 to 3,822 acres in 2014 (USACE, 2015). Additionally, recent surveys of Cat Island showed an increase of 338 acres of SAV in 2014 compared to 2010. The report noted some changes in the spatial coverage of SAV boundaries; however, the general distribution of SAV was reported to be mostly stable (USACE, 2015). No seagrasses occur within the Project area.

Oyster reef: Eastern oysters (*Crassostrea virginica*) are present in Mississippi Sound and provide ecologically important functions. Oyster reefs are formed where a hard substrate and adequate currents are plentiful. Currents carry nutrients to the oysters and take away sediment and waste filtered by the oyster. Most oyster reefs are subtidal or intertidal and found near passes and cuts and along the edges of marshes.

Many organisms, including mollusks, barnacles, crabs, gastropods, amphipods, polychaetes, and isopods, inhabit oyster reefs, forming a very diverse community (Sheridan et al., 1989). Oyster reef communities are dependent upon food resources from the open bay and marshes. Many organisms feed on oysters including fish, such as black drum, crab, and gastropods, such as the oyster drill (*Stramonita haemastoma*) (Lester and Gonzales, 2001; Sheridan et al., 1989). When oyster reefs are exposed during low tides, shore birds will use the reef areas as resting places (Armstrong et al., 1987).

In Mississippi Sound, oyster reefs occur in shallow waters that rapidly change in temperature and salinity. Oyster reefs cover approximately 10,000 to 10,999 acres (GMFMC, 2004). Approximately 97 percent of the commercially harvested oysters in Mississippi come from the reefs in western Mississippi Sound, primarily from Pass Marianne, Telegraph, and Pass Christian reefs. The MDMR manages 17 natural oyster reefs, and there are six private leases ranging in size from 5 to 100 acres each (MDMR, 2011a). In western Mississippi Sound, most oyster reefs are subtidal (>6 feet deep), but some intertidal reefs exist in eastern Mississippi Sound (GMFMC, 2004). Based on the information from the MDMR and observations during the benthic habitat survey in April 2012, no oyster reefs occur within the study or Project area.

Artificial reefs: In the Gulf, two types of artificial reefs exist, those structures placed to serve as oil and gas production platforms and those intentionally placed to serve as artificial reefs (GMFMC, 2004). The more than 4,500 oil and gas structures in the Gulf form unique reef ecosystems that extend throughout the water column, providing a large volume and surface area, dynamic water-flow characteristics, and a strong profile (Ditton and Falk, 1981; Dokken, 1997; Stanley and Wilson, 1990; Vitale and Dokken, 2000). Fish are attracted to oil platforms, because these structures provide food, shelter from predators and ocean currents, and a visual reference which aids in navigation for migrating fishes (Bohnsack, 1989;

Duedall and Champ, 1991; Meier, 1989; Vitale and Dokken, 2000). The size and shape of the structure affects community characteristics of pelagic, demersal, and benthic fish (Stanley and Wilson, 1990). Many scientists believe the presence of oil platform structures increase fishery potential (Scarborough-Bull and Kendall, 1992).

Artificial reefs are colonized by a diverse array of microorganisms, algae, and sessile invertebrates, including shelled forms (barnacles, oysters, and mussels), as well as soft corals (bryozoans, hydroids, sponges, and octocorals) and hard corals (encrusting, colonial forms). These organisms (referred to as the biofouling community) provide habitat and food for many motile invertebrates and fish (GMFMC, 2004).

Species associated with the platforms that are not dependent on the biofouling community for food or cover include the red snapper (*Lutjanus campechanus*), Atlantic spadefish (*Chaetodipterus faber*), lookdown (*Selene vomer*), Atlantic moonfish (*Selene setapinnis*), creole fish (*Paranthias furcifer*), whitespotted soapfish (*Rypticus maculatus*), gray triggerfish (*Balistes capriscus*), and lane snapper (*Lutjanus synagris*), which are all transients (move from platform to platform) and resident species (always found on the platforms) including red snapper, large tomate (*Haemulon aurolineatum*) and some large groupers. Other resident species that are dependent upon the biofouling community for food or cover include numerous species of blennies, sheepshead, and small grazers (butterflyfishes, Chaetodontidae). Highly transient, large predators associated with these structures include the barracuda (*Sphyraena barracuda*), almaco jack (*Seriola rivoliana*), hammerhead sharks (*Sphyrna* spp.), cobia (*Rachycentron canadum*), mackerels (Scombridae), and other jacks (*Caranx* spp.) (GMFMC, 2004).

Mississippi has 15 permitted offshore reefs encompassing 16,000 acres of water bottom and 69 permitted nearshore artificial reef sites (MDMR, 2015). These reefs range in size from 3 to 10,000 acres. The material used for offshore reefs consists of concrete rubble, steel-hull vessels (including barges), armored personnel carriers, and materials of design, such as Florida Limestone Pyramids and Reef Balls. The materials of the nearshore reefs consist of limestone, concrete rubble (when water depth allows), crushed concrete, and oyster shells (MDMR, 2011b). Five nearshore reefs are located within the Project area (MDMR, 2015).

Mississippi's Rigs to Reef Program offers conservation-minded alternatives for the platform, as opposed to onshore disposal with no subsequent habitat value. The average platform jacket can provide up to 3 acres of hard bottom habitat for marine invertebrates and fishes, and these submerged platform jackets currently provide habitat for thousands of marine species. The program includes eight permitted reef sites with 14 platform jackets, none of which are located within the Project area (MDMR, 2011b).

3.0 ESSENTIAL FISH HABITAT SPECIES

As described above, EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802(10)). EFH is found in the tidally influenced or estuarine communities within the Project area (see Figure 2). These communities play an important role in the cycling of nutrients and food energy through coastal ecosystems. Communities, such as wetlands, produce detritus that is transferred to food energy for higher trophic levels via zooplankton, bivalves, crustaceans, and small fish.

Estuaries such as the Mississippi Sound often contribute to the shellfish resources of the Gulf. Shellfish species range from those located only in brackish wetlands to those found mainly in saline marsh and inshore coastal waters. Multiple species of penaeid shrimp are expected to occur in the vicinity of the proposed Project area; however, brown shrimp and white shrimp are the most numerous (Nelson et al., 1992). At least eight species of portunid (swimming) crabs are common residents of the coastal and estuarine waters of the northern Gulf. Brown shrimp, white shrimp, blue crab, and eastern oyster are the primary shellfish located throughout Mississippi that comprise a substantial fishery (Benson, 1982; MDMR, 2009).

Life histories of many Gulf fish can be characterized as estuarine-dependent. These species typically spawn in the Gulf and their larvae are carried inshore by currents. Juvenile fish generally remain in these estuarine nurseries for about a year, taking advantage of the greater availability of food and protection that estuarine habitats afford. Upon reaching maturity, estuarine-dependent fishes migrate to sea to spawn (returning to the estuary on a seasonal basis), or migrate from the shallow estuaries to spend the rest of their lives in deeper offshore waters (Pattillo et al., 1997).

3.1 HABITAT AREAS OF PARTICULAR CONCERN

Within areas identified as EFH, Habitat Areas of Particular Concern (HAPC) may be designated in order to focus conservation priorities on areas that are important to the life cycles of federally managed species and may warrant more targeted protection measures. Designation of specific HAPCs are based on ecological function, habitats sensitive to human-induced environmental degradation, stressors of development activities, and habitat rarity (Dobrzynski and Johnson, 2001). The MSFCMA does not provide any additional regulatory protection to HAPCs. However, if HAPCs are potentially adversely affected, additional inquiries and conservation guidance may result during further EFH consultation with the NMFS (2009). However, no HAPCs are designated in the Project area (NOAA, 2013).

3.2 RECREATIONAL AND COMMERCIAL FISHERIES

Fish and macroinvertebrate species of special concern that occur in the vicinity of the Project area include those with designated EFH and those of commercial and recreational value. In 1996, the MSFCMA mandated the identification of EFH for all federally managed species. Refer to Table 5, for a list of commercial and recreational fisheries species known to occur within and adjacent to the Project area.

The main commercial species in Mississippi Sound are blue crab, southern flounder, Gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*), eastern oyster, red snapper, brown shrimp, pink shrimp (*Farfantepenaeus duorarum*), and white shrimp. The top three commercial species are Gulf menhaden, shrimp, and eastern oysters. Commercial fishing in Mississippi accounts for the lowest income ($113 million) and employment (6,400 jobs) compared to other Gulf states (NMFS, 2010).

Table 5
Representative Recreational and Commercial Fish and Shellfish Species
Known to Occur Within and Adjacent to the Proposed Project Area
Harrison County, Mississippi

Common Name	Scientific Name[1]
Atlantic Croaker	*Micropogonias undulatus*
Atlantic Sharpnose Shark	*Rhizoprionodon terraenovae*
Black Drum	*Pogonias cromis*
Blacktip Shark	*Carcharhinus limbatus*
Blue crab	*Callinectes sapidus*
Blue Runner	*Caranx crysos*
Bluefish	*Pomatomus saltatrix*
Brown shrimp	*Farfantepenaeus aztecus*
Bull Shark	*Carcharhinus leucas*
Cobia	*Rachycentron canadum*
Crevalle Jack	*Caranx hippos*
Greater Amberjack	*Seriola dumerili*
Gulf Menhaden	*Brevoortia patronus*
King Mackerel	*Scomberomorus cavalla*
Lane Snapper	*Lutjanus synagris*
Pink shrimp	*Farfantepenaeus duorarum*
Red Drum	*Sciaenops ocellatus*
Red Snapper	*Lutjanus campechanus*
Sand Seatrout	*Cynoscion arenarius*
Sheepshead	*Archosargus probatocephalus*
Southern Flounder	*Paralichthys lethostigma*
Spanish Mackerel	*Scomberomorus maculatus*
Spotted Seatrout	*Cynoscion nebulosus*
Striped Mullet	*Mugil cephalus*
White shrimp	*Litopenaeus setiferus*

Source: Nelson et al. (1992); Pattillo et al. (1997).
[1] Fish species according to Nelson et al. (2004).

In the recent past, two events had an impact on the fishes of Mississippi Sound: Hurricane Katrina and the Deepwater Horizon oil rig explosion and oil spill. Hurricane Katrina pushed a large amount of saltwater into the rivers and freshwater marshes of Mississippi. Low dissolved oxygen (DO) caused numerous fish kills along the coast and near the mouths of the rivers. Changes in the community structure of the lower Pascagoula River was observed immediately after the hurricane, and some of these changes have persisted because of hurricane-induced habitat changes. Longer term sampling is necessary to assess recovery of fish communities closer to the Gulf (Schaefer et al., 2006).

On May 25, 2010, U.S. Commerce Secretary Gary Locke declared a fishery resource disaster for affected fisheries in waters off Louisiana, Mississippi, and Alabama due to the Deepwater Horizon oil rig explosion and oil spill (Locke, 2010). The incident resulted in discharges of oil and other substances from the rig and the submerged wellhead into the Gulf. Because of the oil spill, 95 percent of Mississippi State waters were closed to commercial and recreational fishing. All Mississippi State waters were reopened in July 2010 after the wellhead was capped and oil stopped flowing into the Gulf (Upton, 2011). Although the fisheries have reopened, the impact of these two events is still under consideration and may not be known for years.

Mississippi remains a key coastal recreational fishery destination on the Gulf Coast. The most common species sought include Atlantic croaker, southern kingfish (*Menticirrhus americanus*), Gulf kingfish (*Menticirrhus littoralis*), sand seatrout, silver seatrout (*Cynoscion nothus*), spotted seatrout, sheepshead (*Archosargus probatocephalus*), red drum, red snapper, sharks, southern flounder, and striped mullet. The most sought after recreational species are sand, silver, and spotted Seatrout and Atlantic croaker. Recreational anglers spent $700,000 in fishing equipment and trips in 2009 (NMFS, 2010).

A description of life history characteristics, habitat preferences, and distribution of commercially and recreationally important species, except for federally managed species as described in Section 3.3, is provided below.

Atlantic Croaker (*Micropognias undulatus*)

Atlantic croaker spawn near passes in the Gulf from September through May. Eggs and sperm are randomly released into the water column for fertilization. Early larval stages are usually offshore and are carried by currents inshore to estuarine habitats. Juvenile Atlantic croaker move into tributaries where they spend 6 to 8 months before migrating offshore starting in March and lasting until November (Pattillo et al., 1997; Lassuy, 1983a). Adults tend to move between estuarine waters typically in the summer and marine waters typically in the fall (Pattillo et al., 1997).

Adult Atlantic croaker are abundant year-round within the Project area (Pattillo et al., 1997; Nelson et al., 1992). Juveniles are abundant in Mississippi Sound from winter to early summer before migrating to the Gulf in the summer (Lassuy, 1983a; Nelson et al., 1992). There is a high probability of juvenile and adult Atlantic croaker occurring in the Project area, especially in fresh-intermediate marshes and open-water habitats.

Black Drum (*Pogonias cromis*)

Black drum is an estuarine dependent species that occurs in open bays and estuaries. Mature black drum spawn in the open bay, in nearshore Gulf waters, or in connecting passes from January to mid-April. During spawning, eggs and sperm are released into the water column for fertilization. Black drum larvae and juveniles move into upper bay areas and tidal creeks, where they remain until they reach about 4 inches in length and then move into the open bay. Black drum remain in the bay until they reach sexual maturity (about 2 years) (Pattillo et al., 1997).

Adult and juvenile black drum are common and occur throughout the Project area year-round (Pattillo et al., 1997; Nelson et al., 1992). Larval and postlarval black drum occur from February through April over the continental shelf; juveniles inhabit muddy bottoms in marsh habitats year-round; and adults are predominantly estuarine, preferring unvegetated sand, mud, and oyster reefs year-round (Pattillo et al., 1997; Sutter et al., 1986; Nelson et al., 1992).

Blue Crab (*Callinectes sapidus*)

Blue crabs are harvested commercially and recreationally throughout the coastal waters of the Gulf. These fisheries have become increasingly important in the Gulf, with reported landings exceeding 49.1 million pounds in 2008 (NOAA, 2010). Blue crabs occupy a variety of habitats, including the upper, middle, and lower estuaries, as well as associated marine environments, depending on their life history stage. Larvae occupy the lower estuary and marine water with salinities greater than 20 parts per thousand (ppt). Blue crabs first enter the estuary during the megalopae life stage, where they begin a benthic existence. Spawning occurs during the spring, summer, and fall (Pattillo et al., 1997).

Factors that affect the distribution and survival of blue crabs are substrate, food availability, water temperature, and salinity. Blue crabs are opportunistic omnivores and feed on fish, detritus, crustaceans, mollusks, and other blue crabs. They are also prey for higher trophic levels, including diving ducks, herons, and predatory fish, including commercial and recreational species (Perry and McIlwain, 1986).

According to Pattillo et al. (1997), all life stages are highly abundant year-round in the Project area. In Mississippi Sound, larval blue crabs are highly abundant May through October; juveniles are abundant May through November; and adults are highly abundant May through March (Nelson et al., 1992).

Gulf Menhaden (*Brevoortia patronus*)

Gulf menhaden occur throughout the northern Gulf from Caloosahatchee River, Florida, to Yucatan, Mexico (Hoese and Moore, 1998). Juvenile menhaden prefer low salinity, open-water habitats adjacent to emergent marsh. Adults often occur offshore. This species makes up a majority of the commercial "pogy" purse-seine fishery. As filter feeders, they feed on phytoplankton, zooplankton, and organic detritus. Both adult and juvenile Gulf menhaden are abundant to highly abundant year-round in Mississippi Sound, with adults moving offshore during the winter months to spawn (Pattillo et al., 1997; Lassuy, 1983b; Nelson et al., 1992). Spawning may occur multiple times during a single spawning season (Lassuy, 1983b). There is a high probability of juvenile and adult Gulf menhaden occurring in the Project area.

Sand Seatrout (*Cynoscion arenarius*)

Sand seatrout is an estuarine species that occurs throughout the Gulf coast in nearshore habitats (Pattillo et al., 1997). Spawning occurs primarily in shallow, higher salinity habitats from February through October (Pattillo et al., 1997; Sutter and McIlwain, 1987). Typical habitats preferred by juvenile sand seatrout are flooded marshes and seagrass meadows with soft organic substrates. Adults are found in open water over most substrates. Sand Seatrout migrate to the Gulf in late fall or winter to spawn. Eggs and sperm are released into the water column for fertilization. Larvae are carried into the estuary by the currents and migrate to the upper areas of the estuary, preferring channels, small bayous, and shallow marshes to develop (Pattillo et al., 1997). Adult Sand Seatrout reach sexual maturity at 12 months (Pattillo et al., 1997). They feed mainly on fish and shrimp (Overstreet and Heard, 1982).

Juveniles are abundant from March through October in Mississippi Sound and adults are abundant from March through December (Nelson et al., 1992). There is a high probability of juvenile and adult sand seatrout occurring in the Project area, especially in tidally influenced emergent wetlands and open-water habitats.

Striped Mullet (*Mugil cephalus*)

Striped mullet spawn offshore near the surface from October to March. Eggs and sperm are released into the water column for fertilization. Once they reach the prejuvenile stage, they enter the bays and estuaries to mature. Sexual maturity is reached at 3 years of age and adults remain near shore throughout their life. All life stages of striped mullet are common throughout the Project area (Collins, 1985; Pattillo et al., 1997). Striped mullet feed mainly on microalgae, detritus, and sediment particles. Adults and juveniles are found year-round, while larval striped mullet are found from October through May in the Project area (Nelson et al., 1992).

Sheepshead (*Archosargus probatocephalus*)

Sheepshead is an estuarine-dependent species that inhabits much of the Atlantic and Gulf coasts of the U.S. Spawning occurs offshore from February through April, with the peak in March and April. Eggs typically are laid over the inner continental shelf (Pattillo et al., 1997). Larvae are pelagic, but move into estuaries, seeking refuge in seagrass (Pattillo et al., 1997; Lee et al., 1980). Juveniles begin leaving seagrass in late summer, congregating with adults around nearshore reefs as they mature (Pattillo et al., 1997; Jennings, 1985). Adults also use oyster reefs, shallow muddy bottoms, marshes, piers and rocks, and over bare sands of the surf zone. Larval and juvenile sheepshead consume primarily zooplankton, whereas larger juveniles and adults prey on blue crab, oysters, clams, and small fish (Pattillo et al., 1997).

This species is considered common in the Project area during the juvenile and adult life stages (Pattillo et al., 1997). Since juveniles are typically associated with seagrass (Pattillo et al., 1997), which does not occur within the Project area, they may occur in the tidally influenced brackish marshes adjacent to the Project area. Adults may occur in open-water habitat and probably will not occur in brackish marsh habitats adjacent to the Project area.

Spotted Seatrout (*Cynoscion nebulosus*)

Spotted seatrout are estuarine residents, spending their entire life cycle in estuarine waters (Lassuy, 1983c). Spawning typically occurs from March to October, with a peak between April and August. Spawning takes place in passes and in shallow, grassy habitats in bays with moderate salinities. Adults and juveniles prefer seagrass meadows and sandy to muddy substrates. Juvenile spotted seatrout feed on zooplankton as larvae, larger invertebrates, and small fish. As adults, their diet consists primarily of fish (Pattillo et al., 1997).

Juvenile spotted seatrout occur in tidally influenced emergent wetlands adjacent to the Project area from February through October. Adults may be found throughout the Project area year-round (Nelson et al., 1992).

Southern Flounder (*Paralichthys lethostigma*)

Southern flounder are distributed throughout estuarine and coastal waters of the Gulf from Florida to Texas (Hoese and Moore, 1998). Spawning occurs during late fall and early winter in nearshore waters (Gilbert, 1986). Once they reach sexual maturity (2 years), they begin migrating to the Gulf to spawn (Pattillo et al., 1997; Daniels, 2000). Juveniles and adults are demersal and prefer estuarine, riverine, or marine environments, depending on the hydrography (Pattillo et al., 1997). This species is found over unconsolidated clayey silts and organic muds, or associated with seagrass meadows or flooded marsh (Pattillo et al., 1997). Southern flounder are carnivorous during most life history stages, feeding mostly on crustaceans (Gilbert, 1986).

Juvenile southern flounder can be found in the Project area year-round, but are most common in spring through fall. Adult southern flounder are also most common in the Project area from spring through late fall. During late fall, they move to deeper offshore waters to spawn (Pattillo et al., 1997; Reagan and Wingo, 1985; Nelson et al., 1992). Within the Project area, southern flounder may occur in the tidally influenced emergent wetlands and within or adjacent to open-water areas.

Eastern Oyster (*Crassostrea virginica*)

Eastern oysters are sessile bivalves that occur throughout the Gulf in shallow bays, mud flats, and offshore sandy bars (Stanley and Sellers, 1986). Oysters grow well on a variety of substrates ranging from rocky bottoms to some types of mud. The presence and growth of oysters are closely correlated with salinity and other abiotic variables. According to Pattillo et al. (1997), salinity, DO, and pH may affect where oysters occur and grow. Salinity ranging from 10.0 to 30.0 ppt, pH ranging from 8.2 to 8.8 standard units (su), and DO ranging from 7.4 to 8.6 milligrams per liter (mg/L) are optimal water quality conditions for oysters (Pattillo et al., 1997). Oysters also depend on currents to deliver food, remove feces, and prevent smothering by sediments.

Oysters spawn from March through November in the northern Gulf, with the peak of spawning season in Mississippi occurring May through October (Stanley and Sellers, 1986). Spawning is triggered mostly by temperatures above 68 degrees Fahrenheit (°F) for normal spawning and above 77 °F for mass spawning (Pattillo et al., 1997). Salinity can also influence spawning. Eggs hatch 6 hours after fertilization, and oyster larvae remain in the water column for 2 to 3 weeks after hatching (Pattillo et al., 1997). Upon settling or attachment, the sessile juveniles are referred to as spat. Spat-fall on the Gulf Coast typically occurs from March to mid-November. Juveniles begin to develop once larvae attach. In the Gulf, sexual maturity of oysters may occur as soon as 4 weeks after attachment (Pattillo et al., 1997), but they are generally mature at 18 to 24 months of age (Quast et al., 1988).

Growth rates of adult oysters can vary greatly depending on conditions. Pattillo et al. (1997) provides growth rates of 2.4 inches in the first year, 3.5 inches in the second year, and 4.5 inches in the third year. It is possible for an oyster to reach harvestable size (3 inches) within 2 years.

Oysters can filter water 1,500 times the volume of their body weight per hour, which in turn influences water clarity and phytoplankton abundance. Due to their lack of mobility and their tendency to bioaccumulate pollutants, oysters are an important indicator species for monitoring contamination (Lester and Gonzalez, 2001).

While oysters can survive in salinities ranging from 5 to 40+ ppt, their optimal range is 10 to 25 ppt, which limits pathogens and predators. The low end of the range is critical for osmotic balance. Oysters can survive brief periods of salinities less than 5 ppt by remaining tightly closed, as long as their energy reserves last. In contrast, predators, such as oyster drills, welks, and crabs, prey on oysters during long periods of high salinities (Cake, 1983). *Perkinsus marinus* (Dermo) is the most common and deadly oyster pathogen in the bays bordering the Gulf. It is most prevalent under warm temperatures and higher salinities, which makes it a primary factor affecting habitat suitability.

No oyster reefs occur within the Project area (MDMR, 2011a).

3.3 FEDERALLY MANAGED SPECIES

Information regarding federally managed species was obtained through the NOAA EFH Mapper v3.0 (NOAA, 2013), NOAA Gulf of Mexico Essential Fish Habitat: Offshore Products (NOAA, 2011), NMFS Essential Fish Habitat Relative Abundance Maps (NMFS, 2011), and NMFS Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2009).

NMFS and the GMFMC identified the Project area as EFH for brown shrimp, pink shrimp, white shrimp, blacknose shark (*Carcharhinus acronotus*), spinner shark (*Carcharhinus brevipinna*), finetooth shark (*Carcharhinus isodon*), bull shark (*Carcharhinus leucas*), blacktip shark (*Carcharhinus limbatus*), Atlantic sharpnose shark (*Rhizoprionodon terraenovae*), scalloped hammerhead shark (*Sphyrna lewini*), great hammerhead shark (*Sphyrna mokarran*), cobia (*Rachycentron canadum*), greater amberjack (*Seriola dumerili*), almaco jack (*Seriola rivoliana*), red snapper, gray snapper (*Lutjanus griseus*), lane snapper, vermilion snapper (*Rhomboplites aurorubens*), red drum, king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), and gray triggerfish (*Balistes capriscus*). The categories of EFH that occur within the Project area include the estuarine water column and estuarine mud and sand bottoms (unvegetated estuarine benthic habitats). Additionally, EFH located adjacent to the Project area include estuarine emergent marsh, seagrasses, oyster reefs, and artificial reefs.

3.3.1 Life History Characteristics of Federally Managed Species

The following describes the preferred habitat, life history stages, and relative abundance of each federally managed species based on information provided by GMFMC (2004). A summary of Mississippi Sound and offshore federally managed species life stages and seasonal abundance is presented in Table 6.

Brown Shrimp (*Farfantepenaeus aztecus*)

Adult brown shrimp are most abundant off the coasts of Texas, Louisiana, and Mississippi from March to December (Pattillo et al., 1997). They inhabit a wide range of water depths up to approximately 360 feet. Nonspawning adults prefer turbid waters and soft sediment. Brown shrimp eggs are demersal and are deposited offshore. The larvae begin to migrate through passes with flood tides into estuaries as postlarvae. Migrating occurs at night mainly from February to April, with some migration in the fall. Brown shrimp postlarvae and juveniles are associated with shallow vegetated habitats in estuaries but are also found over silty sand and nonvegetated mud bottoms. Postlarvae and juveniles occur in salinity ranging from zero to 70 ppt. The density of postlarvae and juveniles is highest in emergent marsh edge habitat and seagrasses, followed by tidal creeks, inner marsh, shallow open water, and oyster reefs (Clark et al., 2004). Juveniles and subadults of brown shrimp occur from secondary estuarine channels out to the continental shelf, but prefer shallow estuarine areas, particularly soft, muddy areas or shell substrates associated with plant-water interface (Rakocinski et al., 1992; Baltz et al., 1993; Peterson and Turner, 1994; GMFMC, 2004). Subadult brown shrimp migrate from estuaries at night on ebb tides during new and full moon phases in the Gulf. Their abundance offshore correlates positively with turbidity and negatively with low DO. Adult brown shrimp inhabit nearshore areas to the continental shelf and are associated with silt, muddy sand, and sandy substrates (GMFMC, 2004). Larval brown shrimp feed on phytoplankton and zooplankton. Postlarvae brown shrimp feed on phytoplankton, epiphytes, and detritus. Juvenile and adult brown shrimp prey on amphipods, polychaetes, and chironomid larvae but graze on algae and detritus (Pattillo et al., 1997; Lassuy, 1983d).

Table 6
Federally Managed Species with the Potential to Occur
in Mississippi Sound and the Project Area

Common Name	Scientific Name	Estuarine		Marine	
		Adults	Juvenile	Adults	Juvenile
Brown shrimp	*Farfantepenaeus aztecus*	common to abundant February–March August–October common to highly abundant May–June rare to common November–January	abundant February–March August–October highly abundant May–July common November–January	major adult area year-round spawn year-round at depths greater than 43 feet	spawning area
Pink shrimp	*Farfantepenaeus duorarum*	common year-round	common year-round	present year-round	nursery area summer and fall
White shrimp	*Litopenaeus setiferus*	common February–March abundant May–January	common Februray–March abundant May–January	present year-round	not present
Blacknose Shark	*Carcharhinus acronotus*	not present		present	
Spinner Shark	*Carcharhinus brevipinna*	not present	present	present	
Finetooth Shark	*Carcharhinus isodon*	present		present	
Bull Shark	*Carcharhinus leucas*	not present	present	present	
Blacktip Shark	*Carcharhinus limbatus*	present		present	
Atlantic Sharpnose Shark	*Rhizoprionodon terraenovae*	present		present	
Scalloped Hammerhead Shark	*Sphyrna lewini*	not present	present	present	
Great Hammerhead Shark	*Sphyrna mokarran*	present		present	
Cobia	*Rachycentron canadum*	present summer	not present	adult area summer spawn in spring and summer	nursery area year-round
Greater Amberjack	*Seriola dumerilli*	not present		present year-round spawning area	present nursery area

Table 6
Federally Managed Species with the Potential to Occur in Mississippi Sound and the Project Area

Common Name	Scientific Name	Estuarine		Marine	
		Adults	Juvenile	Adults	Juvenile
Almaco Jack	*Seriola rivoliana*	not present		present	
Red Snapper	*Lutjanus campechanus*	not present	nursery area year-round	not present	nursery area year-round
Gray Snapper	*Lutjanus griseus*	rare year-round	rare to common February–March common May–January	present year-round	nursery area
Lane Snapper	*Lutjanus synagris*	not present	nursery area	not present	nursery area
Vermilion Snapper	*Rhomboplites aurorubens*	not present		present	
Red Drum	*Sciaenops ocellatus*	common February–October rare to common November–January	common year-round	adult area year-round	nursery area year-round
King Mackerel	*Scomberomorus cavalla*	present		present	nursery area year-round
Spanish Mackerel	*Scomberomorus maculatus*	not present to common February–October not present - rare November–January	common February–October rare November–January	adult area year-round	nursery area year-round
Gray Triggerfish	*Balistes capriscus*	not present		present	

Source: NMFS (2009, 2011); NOAA (2011a, 2011b).

Periods are: Low Salinity Season (February-April); Increasing Salinity (May-July); High Salinity (August-October); and Decreasing Salinity (November-January).

Although adult brown shrimp typically inhabit offshore waters (Pattillo et al., 1997), there is a high probability that they occur within the Project area, as characteristics of the open-water habitat type closely resemble those preferred by adult brown shrimp (e.g., turbid waters and soft sediments) (Pattillo et al., 1997; Lassuy, 1983d). Juvenile brown shrimp are abundant within Mississippi Sound year-round, while adult brown shrimp are abundant from February to October and generally less common from November to January (NMFS, 2011). In the Gulf, adult brown shrimp are common year-round, spawning at depths greater than 40 feet year-round (NOAA, 2011). Brown shrimp are likely to occur in the study and Project areas.

Pink Shrimp (*Farfantepenaeus duorarum*)

Pink shrimp inhabit Gulf and estuarine waters and are either pelagic or demersal, depending on their life stage. After spawning offshore, postlarval pink shrimp recruitment into the estuaries occurs in the spring and fall through passes. Juveniles can be found in seagrass meadows where they burrow into the substrate; however, postlarvae, juveniles, and adults may prefer a mixture of course sand/shell/mud complex. Densities of pink shrimp are lowest or absent in marshes, low in mangroves, and greatest near or in seagrass. Adults occur offshore at depths from 30 to 145 feet and prefer substrates of coarse sand and shell (GMFMC, 2004). Pink shrimp feed on phytoplankton and zooplankton. Postlarvae feed on phytoplankton, epiphytes, and detritus. Juveniles and adults prey on amphipods, polychaetes, chironomid larvae, algae, and detritus (Pattillo et al., 1997).

Adult and juvenile pink shrimp are common year-round in Mississippi Sound. Adult pink shrimp also occur year-round in the Gulf (NMFS, 2011; NOAA, 2011). Pink shrimp are likely to occur in the study and Project areas.

White Shrimp (*Litopenaeus setiferus*)

White shrimp inhabit Gulf and estuarine waters and are pelagic or demersal, depending on their life stage. Their eggs are demersal and larval stages are planktonic and both occur in nearshore Gulf waters. Postlarvae migrate into estuaries through passes from May to November with most migration in June and September. Migration occurs in the upper water column at night and at mid-depths during the day. Postlarval white shrimp become benthic once they reach the estuary where they seek shallow water with mud or sand bottoms high in organic detritus or rich marsh. Postlarvae and juveniles prefer mud or peat bottoms with large quantities of decaying organic matter or seagrasses. Densities are usually highest along marsh edges and in seagrasses, followed by marsh ponds and channels, inner marsh, and oyster reefs. Juvenile white shrimp prefer salinities less than 10 ppt and occur in tidal rivers and tributaries (Muncy, 1984). As juveniles mature, they migrate to coastal areas where they spawn. Adult white shrimp are demersal and inhabit soft mud or silt bottoms (GMFMC, 2004). Nonspawning adults are tolerant of temperatures between 7 and 100 ºF, and survival is high between salinities of 2 and 35 ppt, while spawning adults prefer salinities above 27 ppt. White shrimp larvae feed on phytoplankton and zooplankton. White shrimp postlarvae feed on phytoplankton, epiphytes, and detritus. Juvenile and adult white shrimp prey on amphipods, polychaetes, and chironomid larvae, but also graze on algae and detritus (Pattillo et al., 1997).

Adult and juvenile white shrimp are common to abundant in Mississippi Sound throughout the year. Adult white shrimp also occur year-round throughout the Gulf to depths of about 131 feet (NMFS, 2011; NOAA, 2011). White shrimp are likely to occur in the study and Project areas.

Blacknose Shark (*Carcharhinus acronotus*)

The blacknose shark is a common tropical and warm temperate species found on the continental shelf mainly over sand, shell, and coral bottoms to depths of 60 to 210 feet (Compagno, 1984; Morgan et al., 2008; Driggers et al., 2007). These sharks undergo seasonal migrations to the northern portion of their range, where they reside from March to November. Although little is known about their migrations in the Gulf, blacknose sharks were captured in March 2003, south of Pascagoula, Mississippi, indicating that these sharks move offshore during the late autumn, winter, and early spring months (Driggers et al., 2007; Sulikowski et al., 2007). Blacknose sharks reproduce once a year in the Gulf, which is in contrast to their biennial reproductive cycle in the south Atlantic (Sulikowski et al., 2007; Morgan et al., 2008). They feed on small fish, including pinfish (*Lagodon rhomboids*) and porcupine fish (Diodontidae) (Compagno, 1984). Adult and juvenile blacknose sharks occur in Gulf waters of the study and Project areas (NMFS, 2009; Bethea et al., 2008); however, Drymon et al. (2010) suspect that the north-central Gulf is not a large nursery area for this species.

Spinner Shark (*Carcharhinus brevipinna*)

The spinner shark is a common coastal pelagic species found both inshore and offshore to depths of approximately 240 feet, but most common at depths of less than 100 feet. It is a schooling species that commonly leaps and spins out of the water. Spinner sharks are highly migratory, although their patterns are poorly known. They move inshore during the spring and summer to spawn and feed and possibly southward into deeper water during the fall and winter (Compagno, 1984). The northern Gulf is a nursery area for this species (Benson, 1982). Spinner sharks feed primarily on fish, including sardines, herring, anchovies, catfish, mullet, bluefish, tunas, and jacks (Compagno, 1984). Adult spinner sharks are present in the Gulf portion of the study and Project areas, while juveniles are found in estuarine and Gulf waters of the study and Project areas (NMFS, 2009).

Finetooth Shark (*Carcharhinus isodon*)

While little is known about finetooth sharks, they are an inshore species that are abundant in the Gulf and possibly found at depths up to approximately 35 feet (NMFS, 2009; Froese and Pauly, 2011). Documented nursery habitat is located off the Texas and Louisiana coasts (NMFS, 2009). They probably feed on small boney fish and cephalopods (Compagno, 1984). Adult and juvenile finetooth sharks are found in the estuarine and Gulf portions of the study and Project areas (NMFS, 2009).

Bull Shark (*Carcharhinus leucas*)

Bull sharks have a wide range along the coast and may be found inhabiting shallow waters, especially in bays, rivers, and lakes. They frequently move between fresh and brackish water and are capable of traveling great distances. Adults are often found near estuaries and freshwater tributaries (Froese and Pauly, 2011). Bull sharks are viviparous, have a gestation period of a little less than 1 year, and it is assumed their reproductive cycle occurs every 2 years. Juveniles are found at depths less than 80 feet in shallow coastal waters, inlets, and estuaries (NMFS, 2009). They feed on bony fish, sharks, rays, shrimp, crabs, squid, sea urchins, and sea turtles (Froese and Pauly, 2011). Adult and juvenile bull sharks are present in the estuarine and Gulf portion of the study and Project areas (NMFS, 2009; NOAA, 2013).

Blacktip Shark (*Carcharhinus limbatus*)

Blacktip sharks inhabit shallow waters and offshore surface waters of the continental shelf. They are viviparous and young are born in bay systems in late May and early June after a 1-year gestation period. Their reproductive cycle occurs every 2 years. Juveniles inhabit shallow coastal waters from the shore to the 82-foot isobath (NMFS, 2009). They feed mainly on pelagic and benthic fish, cephalopods and crustaceans, and small rays and sharks (Benson, 1982; Froese and Pauly, 2011). Juvenile and adult blacktip sharks occur in the Gulf and estuarine portions of the study and Project areas (NMFS, 2009; NOAA, 2013).

Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)

The Atlantic sharpnose shark is one of the most common shark species in the northern Gulf (Hoese and Moore, 1998). Migrations are limited to inshore/offshore movements (Benson, 1982). They inhabit intertidal to deeper waters, often in the surf zone off sandy beaches, bays, estuaries, and river mouths (Froese and Pauly, 2011). During the summer, juveniles and adults inhabit shallow inshore waters. Large schools have been observed in Mississippi Sound during the summer, but they migrate offshore during the winter (Benson, 1982). They are viviparous and mating occurs in June, with a gestation period of about 1 year (NMFS, 2009). Juvenile Atlantic sharpnose sharks are found in higher salinity estuaries and the surf zone during the summer (Hoese and Moore, 1998). They feed on fish, shrimp, crab, mollusks, and segmented worms (Froese and Pauly, 2011). Juvenile and adult Atlantic sharpnose sharks occur in the Gulf and estuarine portions of the study and Project areas (NMFS, 2009; NOAA, 2013).

Scalloped Hammerhead Shark (*Sphyrna lewini*)

Scalloped hammerhead sharks are a very common coastal, pelagic species occurring over shelves and deeper water, often entering bays and estuaries (Compagno, 1984). They are found inshore and offshore to depths of approximately 900 feet, but have been found at depths greater than 1,500 feet (Froese and Pauly, 2011). Juvenile scalloped hammerhead sharks occur close to shore in bays, but move deeper as they grow. They prey on a variety of fish and cephalopods (Compagno, 1984). Juvenile scalloped hammerhead sharks are present in the estuarine and Gulf portions of the study and Project areas, while adults are present in the marine portion only (NMFS, 2009).

Great Hammerhead Shark (*Sphyrna mokarran*)

Great hammerhead sharks are a nomadic and migratory coastal pelagic and semi-oceanic species occurring close to shore and offshore to depths over 260 feet (Compagno, 1984). They prey mainly on rays and other flat-bodied fish, but also on other sharks, crabs, squid, and small boney fish (Froese and Pauly, 2011). Breeding occurs once every 2 years with birthing in the late spring to summer (Denham et al., 2007). Adult and juvenile great hammerhead sharks are present in the estuarine and Gulf portions of the study and Project areas (NMFS, 2009).

Cobia (*Rachycentron canadum*)

Cobia are large, pelagic fish occurring nearshore to depths of 230 feet near artificial and natural structures, including floating objects. Spawning occurs from April through September in coastal waters. While cobia rarely use estuarine environments, estuaries are important for most of their prey. They feed mainly on mantis shrimp, eels, crabs, squid, and Spanish mackerel (GMFMC, 2004). All life stages of cobia occur in the Gulf portion of the study and Project areas (NMFS, 2011; NOAA, 2011).

Greater Amberjack (*Seriola dumerili*)

Greater amberjack occur throughout the Gulf to depths of 1,300 feet. Adults are pelagic and epibenthic occurring near reefs and artificial structures. Spawning occurs offshore from May to July, and juveniles are pelagic and associated with floating *Sargassum* mats and debris in the offshore nursery areas (GMFMC, 2004). Adult and juvenile greater amberjacks are found in the Gulf within the study and Project areas (NOAA, 2011).

Almaco Jack (*Seriola rivoliana*)

Adult almaco jack occur in outer reefs and offshore banks over 800 feet and are often associated with oil and gas platforms in the Gulf. Young are often seen offshore seeking refuge around *Sargassum* mats and other floating objects (Froese and Pauly, 2011). Spawning is thought to occur from the spring through fall (GMFMC, 2004), and eggs are pelagic (Froese and Pauly, 2011). All life stages of almaco jack are found in the Gulf within the study and Project areas (NOAA, 2013).

Red Snapper (*Lutjanus campechanus*)

Red snapper are demersal, found over sand and rock substrates, around reefs, and underwater objects to depths of 660 feet. However, adult red snapper prefer depths ranging from 130 to 360 feet (GMFMC, 2004). Spawning occurs in the Gulf from May to July and November to December, at depths of 60 to 120 feet over a firm sand substrate (Moran, 1988). Eggs are found offshore in the summer and late fall. Larvae, postlarvae, and early juveniles occur from July through November in shelf waters (GMFMC, 2004). Early and late juveniles are often associated with underwater structures or small burrows of low relief, but are also abundant over barren sand and mud bottoms (GMFMC, 2004; Gallaway et al., 1999). Juvenile red snapper feed on shrimp, but after age one, prey primarily on fish and squid (GMFMC, 2004; Moran, 1988). Of the vertebrates consumed, most are not obligate reef dwellers, indicating that red snapper feed away from reefs (GMFMC, 2004). Within the study and Project areas, red snapper utilize the Gulf as a nursery area year-round (NOAA, 2011).

Gray Snapper (*Lutjanus griseus*)

Gray snapper can be demersal, structure, or mid-water dwellers inhabiting marine, estuarine, and riverine habitats. They inhabit depths to about 550 feet in the Gulf. Juvenile gray snapper are common in shallow water around seagrasses, while adults tend to congregate in deeper Gulf waters around natural and artificial reefs. Spawning occurs in the Gulf from June to August around structures and shoals. Their eggs are pelagic and the larvae are planktonic, both occurring in Gulf shelf waters and near coral reefs. Postlarvae migrate into the estuaries and are most abundant over *Halodule* and *Syringodium* grassbeds. Juveniles seem to prefer *Thalassia* grassbeds, seagrass meadows, marl bottoms, and mangrove roots, and are found in estuaries, bayous, channels, grassbeds, marshes, mangrove swamps, ponds, and freshwater creeks (GMFMC, 2004). Juvenile gray snapper feed on estuarine-dependent organisms such as shrimp, small fish, and crabs. Gray snapper are classified as opportunistic carnivores at all life stages (Pattillo et al., 1997). In estuaries, juveniles feed on shrimp, larval fish, amphipods, and copepods. Adults feed primarily on fish, but smaller individuals will prey on crustaceans (GMFMC, 2004). In Mississippi Sound, juvenile gray snapper can be common from May to March (NMFS, 2011). Adult and juvenile gray snapper are found in the Gulf waters of the study and Project areas (NOAA, 2011).

Lane Snapper (*Lutjanus synagris*)

Lane snapper are demersal, occurring over all substrate types, but are most commonly found near coral reefs and sandy bottoms. Spawning occurs in Gulf waters from March through September. Nursery areas include mangrove and grassy estuarine habitats in southern Texas and Florida and shallow waters with sand and mud bottoms along all Gulf states (Hoese and Moore, 1998). Juvenile lane snapper appear to favor grass flats, reefs, and soft bottoms to depths of approximately 70 feet. Adult lane snapper occur offshore in depths up to 430 feet near sand bottoms, natural channels, banks, and artificial and natural structures (GMFMC, 2004). Juveniles feed on estuarine-dependent organisms, such as shrimp, small fish, and crabs. Lane snapper are considered unspecialized, opportunistic predators, feeding on a variety of crustaceans and fish. Adults tend to prefer fish (GMFMC, 2004). Juvenile lane snapper are found in Mississippi Sound and in Gulf waters of the study and Project areas (NMFS, 2011; NOAA, 2011).

Vermilion Snapper (*Rhomboplites aurorubens*)

Vermilion snapper are demersal, occurring in waters from 66 to 656 feet deep over rock, gravel, or sand bottoms in the Gulf (Froese and Pauly, 2011; GMFMC, 2004). They often form large schools, especially the young (Froese and Pauly, 2011). Spawning occurs in offshore waters from April to September.

Juveniles are found on hard bottoms, reefs, and artificial structures (GMFMC, 2004). They feed on fish, benthic invertebrates, crabs, and shrimp (Froese and Pauly, 2011). All life stages of vermilion snapper are found in the Gulf within the study and Project areas (NOAA, 2013).

Red Drum (*Sciaenops ocellatus*)

Red drum occupy a variety of habitats, ranging from offshore depths of 130 feet to very shallow estuarine waters. Spawning occurs in the Gulf near the mouths of bays and inlets from August through November, peaking in September and October (Pattillo et al., 1997). Eggs usually hatch in the Gulf and larvae are transported with tidal currents into the estuaries where they mature. Adult red drum use estuaries, but tend to migrate offshore where they spend most of their adult life. Red drum occur over a variety of substrates including sand, mud, and oyster reefs and tolerate a wide range of salinities (GMFMC, 2004).

Estuaries are especially important to larval, juvenile, and subadult red drum. Juveniles are most abundant around marshes, preferring shallow, protected waters over mud substrate or among seagrasses (Stunz et al., 2002a). Juveniles show preference for specific habitat types occurring at higher densities in seagrass meadows (Stunz et al., 2002a), with higher growth rates in brackish emergent marsh and in seagrass meadows (Stunz et al., 2002b). Subadult and adult red drum prefer shallow bay bottoms and oyster reefs (GMFMC, 2004). Estuaries are also important for the prey of larval, juvenile, and subadult red drum. Their larvae feed primarily on shrimp, mysids, and amphipods, while juveniles prefer fish and crabs. Adults feed primarily on shrimp, blue crab, striped mullet, and pinfish (GMFMC, 2004). Adult and juvenile red drum are common year-round in the Gulf and Mississippi Sound within the study and Project areas (NMFS, 2011; NOAA, 2011). Red drum abundance in Mississippi may be due to the close proximity of extensive estuaries in Louisiana (Pattillo et al., 1997).

King Mackerel (*Scomberomorus cavalla*)

King mackerel are pelagic and found in Gulf waters from nearshore to depths of 660 feet, although generally occurring in depths less than 260 feet. Spawning occurs in the Gulf over the outer continental shelf from May to October. Eggs are pelagic, occurring over depths ranging from approximately 100 to 600 feet in the spring and summer months. Nursery areas are located in marine waters with juveniles only occasionally entering estuaries of the study and Project areas (GMFMC, 2004).

While estuaries are important for the variety of prey species king mackerel feed upon, such as squid, shrimp, and other crustaceans, they mainly feed on herrings (GMFMC, 2004). Adult and juvenile king mackerel are found in the estuarine and Gulf portions of the Project area (NOAA, 2011).

Spanish Mackerel (*Scomberomorus maculatus*)

Spanish mackerel are pelagic, inhabiting depths up to 250 feet throughout the coastal zone of the Gulf. Adult Spanish mackerel are usually found from nearshore to the edge of the continental shelf. However, they may also migrate seasonally into estuaries with high salinity, but this migration is infrequent

(GMFMC, 2004). Spawning occurs in the northern Gulf from April through October, peaking in August and September. Larvae typically occur in the Gulf in depths up to 300 feet (Pattillo et al., 1997). Juveniles inhabit the Gulf surf and sometimes estuarine habitats. However, juvenile Spanish mackerel prefer marine salinities and are not considered estuarine-dependent. Juveniles also prefer clean sand bottoms, but the substrate preferences of the other life stages are unknown (GMFMC, 2004). While Spanish mackerel rarely use estuarine environments, estuaries are important for most of their prey. They feed on a variety of fishes, extensively herrings, as well as squid, shrimp, and other crustaceans (Pattillo et al., 1997).

Within Mississippi Sound, both adults and juveniles are common from February to October and uncommon from November to January (NMFS, 2011). Adult and juvenile Spanish mackerel are found in the Gulf year-round within the study and Project areas (NOAA, 2011).

Gray Triggerfish (*Balistes capriscus*)

Adult gray triggerfish occur throughout the Gulf in waters greater than 33 feet on both natural and artificial reefs. Spawning occurs in late spring and summer. Eggs are found in nests prepared in sand near artificial and natural reefs, which are guarded by females and/or males. Larvae, postlarvae, and juveniles are pelagic and are associated with *Sargassum* mats or other floating debris. Juveniles may also be associated with mangroves. Juvenile fish (5 to 7 inches) leave the *Sargassum* habitat in the fall and move to natural and artificial reefs. Gray triggerfish have been observed feeding on sand dollars and sea urchins on soft bottom habitats (GMFMC, 2004). All life stages of gray triggerfish are found in the Gulf within the study and Project areas (NOAA, 2013).

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4.0 POTENTIAL IMPACTS TO EFH

The sections below discuss the No-Action Alternative and the potential impacts from the Proposed Project Alternative on EFH for recreational and commercial fisheries and federally managed species. Adverse effects analyzed of the Proposed Project Alternative include direct and indirect physical, chemical, or biological alterations resulting in the reduction to quality and quantity of EFH and managed species and the cumulative or synergistic consequences.

4.1 ALTERNATIVES ANALYSIS

4.1.1 No-Action Alternative

Under the No-Action Alternative, EFH would remain as described in Sections 2.0 and 3.0. Impacts from current maintenance dredging include temporary increases in turbidity during and shortly after dredging activities and burial of benthic organisms in permitted placement areas. No long-term effects are expected from the No-Action Alternative.

4.1.2 Proposed Project Alternative

Under the Proposed Project Alternative, a total of approximately 7.5 mcy of material would be dredged, including 560,000 cy of debris from the East Pier; any material not structurally suitable for fill at the Project site would be evaluated for potential beneficial use at approved dredged material placement sites. As described previously, the MDMR is pursuing a permit to designate an area in the BMC for BU of dredged material. For the proposed PGEP, the BUG was in favor of a BU site instead of an ODMDS. As such, the BMC is the recommended placement alternative for the new work dredged material for the proposed Project (Anchor QEA LLC, 2015, Appendix E of the EIS).

The debris from the East Pier would be designated for upland disposal. Approximately 178.5 acres of the 264 acres of dredged-open water bottom habitat would be filled and 85.5 acres would become deeper open-water habitat, thus reducing the amount of food and habitat available to some aquatic communities; an additional 18 acres would be filled to develop the breakwater, totaling 282 acres of potential impact from implementation of the Proposed Project Alternative. A total of approximately 29 acres of the 196.5 acres of fill would be comprised of rip-rap which would be placed along the outer perimeter of the West Pier (11.36 acres) and to comprise the breakwater (18 acres) for the primary purpose of shore protection. The proposed breakwater would require placing 250,000 cy of rip-rap over a footprint of approximately 18 acres. The sections below detail the potential impacts to EFH for these species, as well as recreationally and commercially important species listed in Section 3.2.

The Proposed Project Alternative could adversely affect multiple life history stages of several federally managed species. These include the following: all life stages of brown, pink, and white shrimp, blacknose shark, finetooth shark, blacktip shark, Atlantic sharpnose shark, great hammerhead, cobia, greater amberjack, almaco jack, gray snapper, vermilion snapper, red drum, king mackerel, Spanish mackerel, and gray triggerfish; and juvenile life stages of spinner shark, scalloped hammerhead shark, red snapper, and lane snapper. Table 6 provides a summary of federally managed species with the potential to occur in the proposed Project area. The sections below detail the potential impacts to EFH for these species, as well as with recreationally and commercially important species listed in Section 3.2.

4.2 POTENTIAL IMPACTS TO EFH

4.2.1 Estuarine Water Column

The estuarine water column in the vicinity of the proposed Project footprint would be exposed to increased turbidity during Project construction and maintenance dredging. In most cases, turbidity is generally localized and short lived, but may impact federally managed species close to the Project area. The duration and extent of sediments plumes are dependent upon variables that affect currents. Teeter et al. (2003) found that the area of high turbidity extended roughly to the edge of the fluid mud flow or about 1,300 to 1,650 feet from the dredge discharge pipe, but the duration of the higher turbidity was temporary. In most cases, turbidity can be expected to return to near ambient conditions within a few hours after dredging has ceased.

Turbidity in estuarine and coastal waters is generally cited as having a complex set of impacts on a wide array of organisms (Hirsch et al., 1978; Stern and Stickle, 1978; Wright, 1978; Wilber et al., 2005). Turbidity from total suspended solids (TSS) reduces light penetration and, therefore, can reduce primary production, such as phytoplankton growth (Wilber and Clarke, 2001). Such reductions in primary productivity are usually localized and associated with dredging, filling, and placement operations and would be limited to the duration of the plume at a given site. In some cases, the decrease in primary production can be offset to some degree by an increase in nutrients, which are released into the water column during dredging and can stimulate algal growth (Morton, 1977; Newell et al., 1998). Most studies of increased turbidity indicate that adverse impacts to plankton communities are usually localized and of short duration (May, 1973; Armstrong et al., 1987; Valiela, 1995).

Increased sedimentation can impact juvenile and adult fish by reducing feeding efficiency, altering reproductive cycles, and degrading habitat (Newcombe and Jensen, 1996; Clarke and Wilber, 2000). In cases where organisms are exposed to excessive turbidity, the sediments can coat gills; therefore, limiting gas exchange and possibly leading to asphyxiation (Clarke and Wilber, 2000; Wilber and Clarke, 2001). However, many species are motile and can avoid highly turbid areas and, under most conditions, these organisms can survive short exposure (minutes to hours) to elevated turbidity levels (Clarke and Wilber, 2000; Wilber and Clarke, 2001; Newcombe and Jensen, 1996).

Effects of elevated turbidity levels on adult stages of various filter-feeding organisms such as oysters, copepods, and other species include reduced filtering rates and clogging of filtering mechanisms; therefore, interfering with ingestion and respiration and causing abrasion (Newcombe and Jensen, 1996; Wilber and Clarke, 2001; Stern and Stickle, 1978). These effects tend to be more pronounced when TSS concentrations are greater than 100 mg/L, but are apparently reversible once turbidities return to ambient levels (Newcombe and Jensen, 1996). Research has shown that more sensitive species and life stages (i.e., eggs, larvae, and fry) are impacted by longer exposure to suspended sediments than less sensitive species and older life stages (Germano and Cary, 2005; Wilber and Clark, 2001; Wilber et al., 2005; Newcombe and Jensen, 1996). Many crustaceans (such as shrimp and crabs) are less sensitive to suspended sediments, since they reside on or near the bottom where loose sediments naturally occur (Wilber and Clark, 2001; Wilber et al., 2005). Mississippi Sound is often naturally turbid due to the wind and currents. Many of the species tolerate some level of turbidity and no long-term impacts to finfish or shellfish populations are anticipated from construction, dredging, and placement activities associated with the Proposed Project Alternative. Furthermore, the federally managed species are mobile and they would likely avoid areas where suspended solids are too high.

Dredged material is to be used beneficially at approved placement/disposal sites. Allocating dredged material for beneficial use not only reduces the level of traditional placement disruptions, but when properly engineered, has environmental, economic, and social benefits. The BMC is the BU site identified as a candidate for placement of the new work dredged material as part of the Proposed Project Alternative. The ecological function of this habitat variety (i.e., islands, bays, and open-water lakes) serves to support aquatic life in the region. Improvement of this area through beneficial use would serve to enhance the fisheries of the surrounding areas, thus providing support to commercial and recreational fishermen. Restoration of the area would also provide additional storm protection of the coastal region of Louisiana and Hancock County (Anchor QEA LLC, 2015, Appendix E of the EIS).

Vessel traffic would be expected to increase with the Proposed Project Alternative, slightly increasing the probability of a petroleum spill. However, in the event a petroleum spill should occur, most adult shrimp, crabs, and fish are probably mobile enough to avoid areas of high oil concentration. Depending on the product, most petroleum (e.g., crude oil) would remain at or near the surface and typically does not impact motile organisms in deeper water. Lighter petroleum (e.g., some refined products) can disperse into the water column or might have additives that can dissolve in water, potentially impacting less mobile organisms. Larval and juvenile fish and shellfish are more susceptible to petroleum products than adults, since they are less mobile. Population impacts would be greater when early life stages are present. Oil spills would also impact lower levels of the food web; however, phytoplankton and zooplankton can recover rapidly due to high reproductive rates, widespread distribution, and exchange with tidal currents (Kennish, 1992).

Anoxic conditions (<1 mg/L) exist in the Turning Basin area due to its depth and stratification (see Appendix G of the EIS; EPA, 1999, 2013; Orlando et al., 1993; USACE, 2006). Low DO may limit habitat for some nekton and benthic macroinvertebrates. Since the increased area with low DO would be relatively small, it should not measurably affect ecological health in the Project area or Mississippi Sound.

Measurable impacts from chemical contaminants like heavy metals, synthetic organic compounds, cyanide, and nutrients are not expected to occur. This conclusion is based on monitoring and laboratory bioassays conducted since 2000. The results of these analyses are provided below and indicate that no extensive chemical contamination occurs in the Gulfport Harbor or the FNC. The Gulfport Harbor is the portion of the Project area surrounded by industry and is the area most likely to have chemical contamination from adjacent industries, berthed vessels, loading and unloading operations, and stormwater runoff from industrial areas. The lack of significant contamination in the Gulfport Harbor suggests chemical contamination in areas affected by the Proposed Project Alternative would be probably lower than in the Gulfport Harbor.

- Chemicals in water samples from Gulfport Harbor in November and December 2012 were below EPA and Mississippi State Water Quality Criteria (Anchor QEA LLC, 2015, Appendix E of the EIS);
- Dissolved copper was the only chemical in elutriate samples collected from Gulfport Harbor in November and December 2012 that exceeded EPA and Mississippi State Water Quality Criteria (Anchor QEA LLC, 2015, Appendix E of the EIS). Samples for metals in elutriates from different locations throughout the benthic habitat study area were analyzed and all were below Mississippi State Water Quality Criteria (see Appendix E of the EIS). Earlier elutriate monitoring showed levels of ammonia, dieldrin, and endrin that exceeded the Mississippi State Water Quality Criteria, while metals, polychlorinated biphenyls (PCBs), and other pesticides were below criteria or detection limits (USACE, 2006);
- Solid phase and suspended particulate phase toxicity bioassays indicated Turning Basin sediments were not acutely toxic (Anchor QEA LLC, 2015, Appendix E of the EIS). EPA (2013) and USACE (2006) evaluated sediment toxicity and found sediments from the FNC were not acutely toxic;
- Turning Basin sediment contaminants of concern did not bioaccumulate in concentrations statistically greater than U.S. Food and Drug Administration's action levels (Anchor QEA LLC, 2015, Appendix E of the EIS);
- Although nine metals were found in some samples at concentrations exceeding water quality criteria, the measure of whether or not those metals are likely to measurably impact biota includes whether the metals are found in elutriate samples and whether there is acute toxicity during exposure to elutriates or sediments. Most recent monitoring indicates those metals are not likely to elute in high concentrations except for copper, and there is no acute toxicity to elutriate or sediments containing those metals.
- A review of EPA Superfund sites indicated that no Superfund sites are located adjacent to the Gulfport Harbor (Anchor QEA LLC, 2015, Appendix E of the EIS); and
- Review of the USCG's National Response Center website of reports of potential hazardous material releases from 2001 to 2010 revealed no reports of contamination resulting from loss of cargo (Anchor QEA LLC, 2015, Appendix E of the EIS).

- Thompson Engineering Inc. (2015) recently completed testing of potential dredged material associated with the Port of Gulfport Spool Base located adjacent to the existing Port of Gulfport East Pier, in accordance with the Sampling and Analysis Plan (SAP) approved on February 27, 2015 by the MDMR. Sediment analytical results from the recent testing did not identify any detectable concentrations of volatiles or pesticides in the two sediment core borings but found one constituent (acenaphthene) above the Screening Quick Reference Tables threshold effects level (TEL) and probable effects level (PEL) screening levels; however, the reported concentration was below the Mississippi Department of Environmental Quality (MDEQ) Tier 1 Target Remediation Goals (TRGs). Several dioxins and furans were detected in both sediment samples but were also below the MDEQ Tier 1 TRGs. The arsenic concentrations reported in both sediment samples exceeded the MDEQ Tier 1 TRGs and the TEL but were both below the PEL. All other detectable concentrations of constituents were either below the TEL, PEL, and MDEQ Tier 1 TRGs or below the MDEQ Tier 1 TRGs and between the TEL and PEL screening levels. As stated above, placement of the proposed dredged material from the East Pier as part of the proposed Project would meet all applicable regulations and be disposed of in a permitted and approved upland disposal area

In summary, the similarity between sediments in the Gulfport Harbor, FNC, ODMDS, and sites considered minimally impacted in the Mississippi Sound, combined with the general lack of contaminants of concern, indicate that sediment quality impacts resulting from dredge and fill activities associated with the Proposed Project Alternative using any of the placement options considered are not likely to occur (Anchor QEA LLC, 2015, Appendix E of the EIS).

Potential direct take could result from elevated underwater noise from construction and dredging activities resulting in instantaneous death, latent death soon after exposure, or death several days later. The Proposed Project Alternative may result in underwater noise from pile installation, dredging, and boat traffic associated with the Proposed Project Alternative. The Mississippi Sound experiences moderately high volumes of boat traffic, particularly from large vessels accessing the Port of Gulfport. Noise may be generated by vessels associated with construction of the Proposed Project Alternative; however, noise levels are not expected to add to the current background noise levels from existing boat traffic. Therefore, noise from vessels and barges will not be discussed further in this assessment.

The Fisheries Hydroacoustic Working Group (FHWG), a multi-agency work group, developed criteria for the acoustic levels at which various physiological effects to fish could be expected (FHWG, 2008). The criteria were developed primarily for species on the west coast of the U.S.; however, the NMFS and USFWS have relied on these criteria for assessing projects on the east coast and Gulf of Mexico for sound effects analysis (USFWS, 2015). The FHWG determined that peak sound pressure waves should be within a single strike threshold of 206 decibels (dB), and the cumulative sound exposure level (cSEL) associated with a series of pile strike events should be less than 187 dB cSEL to protect listed fish species that are larger than 2 grams, and less than 183 dB cSEL for fish species that are smaller than 2 grams (FHWG 2008).

The Proposed Project Alternative includes the installation of approximately 4,000 pre-stressed concrete piles for construction of the new wharf associated with the West Pier Expansion. These piles would consist of approximately 2,680 24-inch x 24-inch square, pre-stressed concrete piles that range in length from 80 feet to 100 feet. The remaining 1,320 piles would be 36-inch cylindrical, hollow, pre-stressed concrete piles installed along the outside edge of the wharf to support the crane rail. The proposed installation plan estimates driving 6 piles per day in approximately 20-foot water depth, within a 10-hour work day. Using one installation rig, the installation would occur 6 days per week and take approximately 2.5 years to complete. However, if a second installation rig is utilized, up to 12 piles could be driven in a single work day. The installation may include pre-augering or jetting the piles for the first 65 to 70 feet; the remaining 10-15 feet would be driven with a standard pile-driving hammer to set the bearing capacity of the pile. The estimated total number of strikes per day would range from 3,768 to 15,132.

The NMFS Pile Driving Calculator Model was used to assess the potential underwater noise impacts from pile driving for the Proposed Project Alternative (NMFS, 2015). This model is based on data from similar piles in similar substrate and requires an estimate of the total number of strikes per day to install the piles. Assumptions for input into the NMFS model were based on the number of strikes proposed for the 24-inch x 24-inch square pre-stressed concrete piles and the 36-inch cylindrical, hollow, pre-stressed concrete piles. Reference noise levels were selected from the Compendium of Pile Driving Sound Data, updated in October 2012, to represent the Proposed Project Alternative (Caltrans, 2012).

Based on the size of the piles and estimated water depth, noise generated by installation of the square and cylindrical piles is estimated to be 185 dB peak, with a cumulative strike sound exposure level of 207 dB cSEL, and root mean square (RMS) sound levels of 163 dB (square piles) and 165 dB (cylindrical piles). Based on a scenario of 3,768 total strikes per day (2,512 strikes for the square piles and 1,256 strikes for the cylindrical piles), the model analysis shows that the threshold for physical injury to listed fish species that are larger than 2 grams would have the potential to be exceeded up to 705 feet from the installation site for both square and cylindrical piles. The threshold for physical injury to fish species that are smaller than 2 grams would have the potential to be exceeded up to 1,118 feet for the square piles and 1,302 feet for the cylindrical piles, refer to the BA prepared for the EIS (Appendix J).

Calculations for the pile driving scenario of 15,132 total strikes per day (10,088 strikes for the square piles and 5,044 strikes for the cylindrical piles), show that the noise generated by installation of the square and cylindrical piles is estimated to be 185 dB peak, with a cumulative strike sound exposure level of 213 dB cSEL, and RMS sound levels of 163 dB (square piles) and 165 dB (cylindrical piles). The threshold for physical injury would have the potential to be exceeded within up to 1,118 and 1,775 feet from the installation site of square piles and cylindrical piles, respectively, for fish species both larger and smaller than 2 grams.

Based on the underwater noise analysis, the proposed pile driving of the aforementioned piles would likely exceed the adopted underwater noise thresholds for physical and behavioral impacts to fish species. Sound pressure levels in excess of the disturbance threshold (but below the threshold for injury) can potentially cause temporary behavioral changes that may increase the risk for predation and reduce an individual fish's likelihood of foraging or spawning success.

Noise impacts from dredging associated with the Proposed Project Alternative may occur. It is estimated that a dredge would have a noise level of 70 dBA (A-weighted decibels) at 50-foot water depth (see Section 4.6.4.1 of the EIS). Based on this information, the noise level produced from dredging activities would be below the interim fish injury thresholds currently accepted by the NMFS, 206 dB peak level sound measurement (LPEAK), and 187 dB cSEL (Federal Highway Administration, 2012).

4.2.2 Estuarine Mud and Sand Bottoms

The proposed Project would alter the benthic habitat through dredging, filling, and placement activities. Of the 264 acres of dredged area, 178.5 acres would be filled and 85.5 acres would become deeper open-water habitat; an additional 18 acres would be filled to develop the breakwater. The Mississippi Sound contains approximately 452,000 acres of estuarine mud and sand bottom habitat. The loss of 196.5 acres of estuarine mud and sand bottom habitat would be a small fraction (0.04 percent) of the total available habitat within the entire system.

Excavation removes and buries benthic organisms, whereas placement smothers or buries benthic communities. Dredging, filling, and placement of dredged material may cause ecological damage to benthic organisms in three ways: (1) physical disturbance to benthic ecosystems; (2) mobilization of sediment contaminants, making them more bio-available; and (3) increasing the amount of suspended sediment in the water column (Montagna et al., 1998). Dredging can result in a reduction of species diversity by 30 to 70 percent, the number of individuals by 40 to 95 percent, and a similar reduction in the biomass of benthic fauna existing within the boundaries of dredged areas (Newell et al., 1998).

Recolonization of areas impacted by dredging and dredged material disposal occurs through vertical migration of buried organisms through the dredged material, immigration of postlarval organisms from the surrounding area, larval recruitment from the water column, and/or sediments slumping from the side of the dredged area (Bolam and Rees, 2003; Newell et al., 1998). The response and recovery of the benthic community from dredged material placement is affected by many factors, including environmental (e.g., water quality, water stratification), sediment type and frequency, and timing of disposal. Communities in these ecosystems are dominated by opportunistic species tolerant of a wide range of conditions (Bolam et al., 2010; Bolam and Rees, 2003; Newell et al., 1998, 2004). Although changes in community structure, composition, and function may occur, these impacts would be temporary in some dredging and disposal areas (Bolam and Rees, 2003). Shallower, higher energy estuarine habitats can recover within 1 to 10 months from perturbation, while deeper, more-stable habitats can take up to 8 years to recover (Bolam et al., 2010; Bolam and Rees, 2003; Newell et al., 1998; Sheridan, 1999, 2004; Wilber et al., 2006; VanDerWal et al., 2011).

Maurer et al. (1986) demonstrated that many benthic organisms were able to migrate vertically through 35 inches of dredged material; however, the species present in early succession stages of recovery are not the same as those buried by the dredged material. Although vertical migration is possible, most organisms at the center of the disturbance do not survive, and survival was shown to increase as distance from the disturbance increased (Bolam and Rees, 2003; Maurer et al., 1986). The release of nutrients during dredging may enhance benthic organism diversity and population densities outside the immediate dredge placement area, as long as the dredged material is not contaminated (Newell et al., 1998).

The impact to benthic organisms would likely be confined to the immediate vicinity of the dredge footprint associated with the proposed PGEP (Newell et al., 1998), and the recovery of benthic macroinvertebrates following burial is typically rapid (recovering within months rather than years) (VanDerWal et al., 2011; Wilber et al., 2006; Wilber and Clarke, 2001); thus, no long-term impacts to benthic organisms are expected from the Proposed Project Alternative. Because of the constant re-creation of "new" habitat via disturbance, new recruits continually settle and grow, although communities are dominated by small, surface-dwelling organisms with rapid growth rates. Consequently, dredged material placement from the Proposed Project Alternative may result in a shift in community structure rather than a decrease in production (Bolam and Rees, 2003; Montagna et al., 1998). However, 196.5 acres of estuarine mud and sand bottom habitat would be permanently removed by filling. This area would not have the opportunity for benthic macroinvertebrate recovery.

Dissolved oxygen levels in deepened parts of the Turning Basin area would be measurably lower, and most of the time would remain lower than adjacent waters in the Project area. These hypoxic conditions may exclude some benthic organisms; however, the area would be very small and should not measurably affect ecological health in the Project area.

4.2.3 Estuarine Emergent Marsh and Seagrasses

No estuarine emergent marsh or seagrass habitat occurs within the Project area. Although these resources occur proximal to the Project area, they are present in small, isolated patches (see Figure 3). Most estuarine emergent marshes occur within the estuaries of Bay St. Louis or Biloxi Bay, outside the proposed Project area. One wetland was mapped in the National Wetlands Inventory (NWI) within the proposed Project area, which is 5.45 acres and identified as a persistently inundated intertidal emergent estuarine wetland. Historically, this area was a man-made stormwater retention pond that facilitated wetland vegetation growth over time. According to recent aerial imagery, this wetland feature was previously incorporated into a Port restoration area and no longer exists within the proposed Project area.

Since the Proposed Project Alternative would not be expected to significantly change water exchange and inflow patterns, impacts to adjacent emergent marsh and seagrass habitats are not expected. Thus, no impacts to EFH estuarine emergent marsh or seagrass habitat are anticipated with the Proposed Project Alternative.

4.2.4 Oyster Reef

No oyster reefs occur within the Project area or study area; therefore, no impacts are anticipated.

4.2.5 Artificial Reefs

Five nearshore artificial reefs are located within the Project area. Water column turbidity is expected to increase during proposed Project construction and associated maintenance dredging, although it would be temporary and motile organisms should avoid highly turbid areas (Clarke and Wilber, 2000; Wilber and Clarke, 2001; Newcombe and Jensen, 1996). Thus, no long-term impacts are expected to artificial reefs.

4.2.6 Potential Indirect Impacts to EFH

Potential indirect impacts from noise to the estuarine water column could potentially make fish susceptible to predation, disease, starvation, or affect an individual's ability to complete its life cycle. Behavioral changes resulting from underwater noise could cause fish to alter their movement and foraging patterns. The proposed Project may increase future ship traffic, thereby increasing the potential for accidental releases of exotic species into the local waters via ship ballast water and, to a lesser extent, within cargo, or from ship hulls. Ballast water impacts could introduce plant and animal organisms ranging in size from plankton to small fish. The indirect effect from the introduction of contaminated ballast water would be minimized with the USCG regulations that mandate ballast water exchange to reduce impacts from invasive/exotic species.

4.3 POTENTIAL IMPACTS TO FEDERALLY MANAGED SPECIES

The potential for adverse impacts to federally managed species within the Project area is likely to differ from species to species, depending upon life history, habitat use (demersal vs. pelagic), distribution, and abundance.

4.3.1 Direct Impacts

No estuarine emergent marshes or seagrass habitat occurs within the proposed Project area or Project footprint; therefore, none of these habitats would be directly impacted by the proposed Project. Dredged material is to be used beneficially within approved placement sites, such as the BMC.

The Proposed Project Alternative could temporarily reduce the quality of EFH in the vicinity of the Project area and some individual species may be displaced. This alternative would result in the permanent loss of 196.5 acres of shallow estuarine mud and sand bottom habitat to construct the proposed Project and permanent conversion of 85.5 acres to deeper habitat, thus reducing the amount of food available to federally managed species.

Since most fish can avoid highly turbid areas (Clarke and Wilber, 2000), they may temporarily relocate and feed in undisturbed areas until recovery is complete from dredging-related solids. Feeding habits of shrimp would not be impacted, since shrimp typically reside on or near the bottom where sedimentation naturally occurs (Wilber and Clark, 2001; Wilber et al., 2005).

Dredging, filling, and placement activities are not expected to cause direct mortality to juvenile and adult pelagic finfish, since these life history stages are motile and are capable of avoiding highly turbid areas associated with Project construction (Clarke and Wilber, 2000). Penaeid shrimp use deeper water of the bay as a staging area from which they migrate to the Gulf during certain times of the year (GMFMC, 2004). The displacement of juvenile and adult finfish and shrimp during Project construction would likely be temporary and individuals should return to these specific areas once the Project is completed. Juvenile and adult finfish and shrimp should experience minimal direct impacts from dredging and placement activities. Juvenile penaeid shrimp may be impacted due to their preference for burrowing in soft muddy areas, although these are usually in association with plant/water interfaces.

Demersal eggs and larval finfish may be lost to physical abrasion, burial, or suffocation during dredging and placement activities, because their mobility is limited and they are more sensitive to suspended sediments (Newcombe and Jensen, 1996; Wilber and Clark, 2001; Stern and Stickle, 1978; Germano and Cary, 2005; Wilber et al., 2005). Older life stages are generally more mobile and less sensitive to turbidity. Section 4.2 provides additional descriptions on impacts.

Federally managed species are not expected to be adversely affected by contaminants associated with dredged material that may be used for beneficial use. Section 4.2 provides an overview of sampling results from the Project area. With the exception of a limited number of elutriate samples, most parameters were either below detection limits or were within state and/or federal criteria for surface waters. However, the potential for contaminant impacts associated with spills (e.g., crude or refined oil) may increase because of higher port use associated with the Proposed Project Alternative. Impacts associated with spills are summarized in Section 4.2. Compared to adults, impacts to early life stages of federally managed species may be disproportionately affected due to their higher sensitivity and lower mobility.

In summary, the Proposed Project Alternative would result in the permanent loss of the estuarine water column and estuarine mud and sand bottom habitat. Some turbidity-related impacts, particularly to early life stages, would occur with dredging, filling, and placement activities; however, those impacts would be temporary and localized. Thus, there should not be substantial reductions in federally managed fish/shellfish populations. In most cases, affected species would return to the areas once dredging is completed. Dredged material is also to be used beneficially at approved placement sites, such as the BMC.

4.3.2 Indirect Impacts

Indirect impacts include a reduction in prey for federally managed species due to the mortality or displacement of benthic species, associated with dredging, placement, and filling activities. Since benthic organisms serve as prey for finfish, their mortality may temporarily reduce finfish feeding. With the exception of the permanent loss of 196.5 acres of estuarine mud and sand bottom habitat, disturbances to the benthic environment would be short lived and impacts would be minimal.

4.4 CUMULATIVE IMPACTS

A cumulative impacts assessment takes into consideration the impact on the environment, which results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Impacts include both direct effects, which are caused by an action and occur at the same time and place as the proposed action, and indirect effects, which are also caused by the action and occur later in time and are farther removed in distance, but which are still reasonably foreseeable. Ecological effects refer to effects on natural resources and on the components, structures, and functioning of affected ecosystems, whether direct, indirect, or cumulative. A comprehensive cumulative impact assessment is presented in Section 5 of the EIS.

In summary, five projects were determined to be “reasonably foreseeable future actions” to occur in the vicinity of the Proposed Project Alternative. These projects include the Ward Investments Project, Maritime Commerce Center, Gulfport FNC Modification with Bend Easing, Mississippi Department of Transportation’s I-310 Project, and the MsCIP Barrier Island Restoration Project (Ship Island and Cat Island) and all occur within the study area. Project details or potential impacts to the surrounding environment are not available for the Maritime Commerce Center. At this time, no other project details or potential impacts to the surrounding environment are available; thus, this project was not included in the cumulative impacts analysis.

In addition, the following projects or actions represent “past or present actions” relative to the study area:

- Maintenance Dredging (refer to Section 5.3.1 in the EIS for recent maintenance dredging activities)
- Beneficial Use Sites and ODMDS
- Gulfport Harbor Navigation Channel Widening Project
- Port of Gulfport Restoration Project (referred to as the “Port of Gulfport Restoration: 60-acre fill” and “Port of Gulfport Restoration 24-acre fill” in Table 7)
- KCS Rail Improvements Project
- City of Gulfport Small Craft Harbor Redevelopment
- Widening of the Pascagoula Lower Sound/Bayou Casotte Channel
- MsCIP Interim Near-Term Projects
    - Shearwater Bridge Erosion Control and Hurricane Storm Damage Reduction
    - Long Beach Canals
    - Harrison County Beaches Ecosystem Restoration and Hurricane Storm Damage Reduction
    - Courthouse Road Flood Damage Reduction and Ecosystem Restoration

- MsCIP Comprehensive Plan Projects
  - Coast-wide Beach and Dune Ecosystem Restoration
  - West Ship Island North Shore Restoration
  - Deer Island Ecosystem Restoration
  - Forrest Heights Levee Improvements
  - Turkey Creek Ecosystem Restoration
- CIAP Projects
  - Henderson Point Greenway
  - Blakeslee Preserve Habitat Restoration
  - Tchoutacabouffa River Greenway
  - Biloxi River Greenway
  - Harrison County Watershed Assessment and Restoration Projects
  - Oyster Bayou Restoration
  - Acquisition and Restoration of Flood-prone Properties for Green Space, Phases 1 and 2

Placement of dredged material at the Pascagoula ODMDS and possible BMC site represent "past or present actions," and occur just outside of the study area. These actions were not included individually in the resource tables because their impacts are generally limited to only a few resource areas; however, they are described and their impacts are included for applicable projects utilizing these locations and in the total column of resource tables. Projects that are deemed to have no effect on any listed species or have insufficient details to make a determination of the level of impact are not included in this cumulative effects analysis.

The primary concern associated with open-water habitats is increased turbidity, which occurs as a result of sediment release during dredging and construction activities. Turbidity in estuarine and coastal waters generally has complex implications for a range of organisms (Hirsch et al., 1978; Stern and Stickle, 1978; Wright, 1978; Wilber et al., 2005). Suspended material can both benefit and adversely impact aquatic communities. Increased turbidity can decrease light available for photosynthetic activity, reducing plankton production. Conversely, the decrease in primary production can be offset by an increase in nutrient primary productivity that is released into the water column during dredging activities when the water clears (Morton, 1977; Newell et al., 1998). The impacts to phytoplankton and algae from Project construction, dredging, and dredged material placement of new work and maintenance material would be temporary. Increased sedimentation would impact juvenile and adult finfish by disrupting foraging and feeding patterns; however, these impacts would also be temporary and short-term within the proposed Project area. While elevated turbidities will impact the adult stages of filter-feeding organisms (e.g., oysters and copepods) by clogging filtering mechanisms, impacts would be short-term and localized over the 50-year project life.

Considering past, present, and reasonably foreseeable future projects in the proposed Project area, impacts to benthic communities would generally be associated with dredging and placement activities. Those evaluated projects involving a modification (e.g., widening) of an existing navigational channel, such as the Proposed Widening of the Pascagoula Lower Sound/Bayou Casotte Channel and Gulfport Harbor Navigation Channel Widening Project, could result in the permanent conversion of shallow, primarily silty clay soft bottom, to a deeper hypoxic habitat. Bottom habitat at the Littoral Zone Disposal Area and open-water disposal areas would be buried during dredged material placement affecting benthic communities and oyster reefs; however, these sites are approved and active sites for maintenance dredging material placement. Buried organisms would be negatively impacted, but recolonization would occur.

Similarly, dredging operations have or would temporarily reduce the quality of EFH where present in the vicinity of any of the evaluated projects, such as the Proposed Widening of the Pascagoula Lower Sound/ Bayou Casotte Channel, which may temporarily reduce EFH quality. Some projects, such as the Gulfport Harbor Navigation Channel Widening Project, as detailed in Table 7, cause the permanent conversion of shallow, primarily silt and clay soft bottom habitats to deeper, hypoxic habitat, which reduces the functionality and ability of this natural community type to support aquatic species including federally managed fish/shellfish populations. While the overall cumulative conversion of estuarine mud and sand bottom habitat may be considered minor on a project-by-project basis and even collectively across all evaluated projects when compared to the entire 470,000-acre Mississippi Sound, of which approximately 452,000 acres is estuarine mud and sand bottoms, the habitat conversion represents a net loss of a more productive habitat (when compared with deeper, dredged channel bottom). Evaluated projects do not indicate impacts to seagrasses. Fish and shellfish species would temporarily shift feeding habitats during dredging operations to undisturbed areas until dredging and/or construction activities have been suspended and habitat recovery has occurred. Dredged material placement for any of the evaluated projects is not anticipated to cause long-term contamination problems for EFH based on available information.

An increase in throughput may result in a slight spill risk increase or introduction of an invasive species via ballast water, while expansion of the Turning Basin may lower the probability of spills; however, those probabilities are not quantified. As documented with the Deepwater Horizon oil rig explosion and oil spill, large spills, such as those from loaded ships, can have devastating impacts to aquatic communities. Smaller releases of crude oil or petroleum products impact shallow sessile or dermal organisms, birds and other coastal wildlife, and littoral habitats. Mobile organisms, such as fish and many shellfish generally avoid oil spills since the products generally float. However, releases of soluble products can have impacts to the entire water column. Due to the increased throughput and larger vessels/volumes, the risk of larger spills than under existing conditions is possible. However, the cumulative risk of these types of risk are not expected to be high based on the low frequency of incidents in the past (Anchor QEA LLC, 2015, see Appendix E of the EIS) and increased State and Federal focus on spill prevention and response over the past 20 years. Vessel traffic, as a result of implementing the evaluated projects and continued moderate economic growth, may increase the volume of ballast water discharged into the Sound and the associated potential for release of invasive species. However, none of the evaluated projects anticipated increased vessel traffic. Although the Proposed Project Alternative would result in increased vessel traffic over time, USCG mandatory ballast water management protocols would be in place for all vessels; therefore, minimal cumulative impacts from ballast water and the introduction of invasive species is anticipated.

Past, present, and reasonably foreseeable future projects in the proposed Project area are unlikely to contribute long-term, adverse cumulative impacts to aquatic resources, as detailed in Table 7. Moreover, long-term beneficial cumulative impacts would result from MsCIP, MDMR CIAP projects, and other projects that aim to restore wetlands, watersheds, and barrier islands that affect circulation and aquatic ecology within the Mississippi Sound. The Proposed Project Alternative would permanently alter estuarine mud and sand bottom habitat by filling during construction and result in temporary and localized disturbances and impacts due to dredging and placement activities. If the BMC or other approved BU sites is used for beneficial disposal of dredged material, the Proposed Project Alternative would not contribute detrimental cumulative impacts to aquatic resources in the Project or surrounding areas.

Table 7
Cumulative Impacts to Essential Fish Habitat

Action	Essential Fish Habitat
Proposed Project Alternative	Loss of 196.5 acres of estuarine mud and sand bottoms and permanent conversion of 85.5 acres to deeper habitat; temporary and localized turbidity increases during project construction, dredging within the project area, and dredged material placement; removal of benthic community; burial of benthic organisms at fill and placement areas; positive benefit of dredged material to be used beneficially within the BMC
Ward Investments Project	N/A; however, would fill 383 acres of wetlands or floodplains with adverse impacts to aquatic ecology; mitigation for wetland impacts are required to offset impacts
Proposed Widening of the Pascagoula Lower Sound/Bayou Casotte Channel	Impacts to open-water communities as a result of increased turbidity during dredging localized around the immediate area of dredging and placement and limited to duration of the plume at a given site, but may temporarily impact localized primary production levels, finfish foraging, and distribution patterns, and filter feeder filtering rates; potential temporary reduction in quality of EFH and displacement of individual species; permanent conversion of 87.6 acres of shallow habitat to deeper habitat and temporary burial of benthic organisms in placement sites; no long-term effects on benthic organisms are expected due to motility, rapid recovery of benthic communities following temporary, short-term impacts in the immediate vicinity of the area dredged; no long-term turbidity impacts on artificial reefs are anticipated because of their distance from the proposed Project area
Gulfport Federal Navigation Channel Modification with Bend Easing Project	Loss of estuarine water column and estuarine mud and sand bottom could impact federally managed species through reduction of food availability. Dredging and placement activities may result in loss of demersal eggs and larval finfish. Slight reduction in probability of a petroleum spill due to increased vessel traffic safety.

Action	Essential Fish Habitat
Barrier Island Restoration (Ship Island and Cat Island)	Placement of approximately 22 mcy of sand in Camille Cut and replenishment of the southern shoreline of East Ship Island and beach-front placement of sand along the eastern shoreline of Cat Island; convert open water to beach habitat; temporary and localized minor impacts during placement activities
Coast-wide Beach and Dune Restoration	No impacts anticipated
West Ship Island North Shore Restoration	Positive ecological benefits
Deer Island Restoration	Restores diverse habitat to juvenile species; direct positive benefit via improved estuarine functions
Forrest Heights Levee Improvement	Slight degradation of existing biological resources due to enlarged footprint of levee; resources of Turkey Creek improved
Turkey Creek Ecosystem Restoration	Positive habitat benefits; improved water quality
CIAP Projects	Positive ecological benefits from preservation, conservation, and restoration activities
MDOT's I-310 Project	N/A; however, would fill 162.09 acres of wetlands, including hydric flatwoods, cypress/gum slough and emergent marsh of medium to high quality; fill would cause loss of habitat, injury or death of less mobile species and displacement of mobile species; adverse impacts would be offset by mitigation
KCS Rail Improvements Project	No impacts anticipated; project activities occurred within the existing KCS right-of-way, which has been developed and maintained since the early 1900s
Courthouse Road Flood Damage Reduction	Potential positive habitat benefits from marsh restoration (e.g., nursery areas for fishes, shellfish, and crustaceans)
Shearwater Bridge Storm Damage Reduction	Improved health from stabilization of the bridge abutments and shoreline armoring
Long Beach Canals	Temporary and localized displacement of fauna during construction; long-term benefits from increased circulation and tidal exchange (e.g., fish allowed to migrate upstream)
Harrison County Beaches Ecosystem Restoration and Hurricane Storm Damage Reduction	N/A
Port of Gulfport Restoration: 24-acre fill	Reduction of open-water habitat in the Mississippi Sound; the MSPA has taken steps to mitigate loss of open-water habitat by implementing a comprehensive mitigation plan that enhances estuarine habitat; temporary localized increase in turbidity during construction will cause minor impacts; mobile aquatic organisms would avoid project area during construction; permanent loss of 24 acres of Mississippi Sound; no long-term impacts to aquatic resources
Port of Gulfport Restoration: 60-acre fill	Negative impacts from loss of 60 acres of estuarine mud and sand bottom; impacts mitigated by estuarine benefits; no long-term impacts to aquatic resources; minor short-term impacts from increased turbidity
Gulfport Small Craft Harbor Redevelopment	Temporary impacts to immobile species and temporary adverse impacts on habitat quality due to turbidity during dredging
Maintenance Dredging	Temporary and minor adverse impact through disruption; nonmotile benthic fauna lost but should repopulate within several months; temporary displacement of motile species during operations

Action	Essential Fish Habitat
Gulfport Harbor Navigation Channel Widening Project	Short-term minor displacement and loss of infaunal and epifaunal benthic invertebrates, mollusks, and crustaceans, displacement of fish, and temporary and negligible impacts to foraging behavior and activity patterns of marine mammals during dredging and disposal activities with quick recovery; temporary adverse impacts to EFH in vicinity of dredging activities; beneficial impact to nearshore habitats through renourishment and protection from erosion with dredge material placement near Cat Island and the Chandeleur Islands
Qualitative Summary of Cumulative Impacts	Fill actions would have cumulative adverse impact of removing estuarine mud and sand bottoms and wetlands and burial of benthic organisms; dredging would result in conversion to deeper habitat, dredging and placement would result in temporary and localized turbidity increases, removal of benthic community, burial of benthic organisms at placement areas; most adverse impacts would be offset by mitigation and should not have a net cumulative adverse effect; cumulative increase in vessel traffic in the Project area would increase the risk of pollution; restoration, stabilization, protection, and beneficial use actions would have a cumulative beneficial effect on aquatic ecology

5.0 CONCLUSIONS

The federally managed species discussed in this EFH Assessment utilize the estuarine and Gulf habitat in and adjacent to the Project area during some portion of their life for spawning, food, development, and/or protection (GMFMC, 2004). The Proposed Project Alternative will have negative impacts, both directly and indirectly, to EFH in the Project area.

Dredging activities would temporarily affect EFH by disturbing bottom sediments and increasing turbidity in both the marine and estuarine waters column in the vicinity of dredging activity, which can have adverse effects on finfish and shellfish species. Dredging would also directly affect estuarine and Gulf bottom habitats. Considering the nature of the sediments that would be dredged and the temporary nature of dredging activities, these impacts should not be significant.

The proposed Project would result in the permanent loss of 196.5 acres of estuarine water column and estuarine mud and sand bottom habitat; however, the proposed impacts may affect, but are not likely to adversely affect EFH. There are no HAPCs designated in the Project area (NOAA, 2013). In addition, no EPA Special Aquatic Sites are located in the Project area.

The EIS served to initiate EFH consultation under the MSFCMA. Prior to Final EIS release to the public, this EFH Assessment will allow NMFS and GMFMC an opportunity to provide comments on EFH impacts.

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Appendix A

National Marine Fisheries Service Correspondence

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701
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http://sero.nmfs.noaa.gov

May 11, 2010 F/SER46:MT

Colonel Byron G. Jorns
District Engineer, Mobile District
Regulatory Division
Department of the Army, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Colonel Jorns:

NOAA's National Marine Fisheries Service, Southeast Region, Habitat Conservation Division (NMFS) has reviewed public notice number SAM-2009-01768-DMY dated April 16, 2010. The applicant, Mississippi State Port Authority (MSPA), has requested a Department of the Army permit to dredge approximately 332 acres for new channel and harbor expansion and fill 700 acres of open water benthic habitat to construct new port facilities in Mississippi Sound, Harrison County, Mississippi. This proposal includes placing 38,400,000 cubic yards of fill material, removing 17,260,000 cubic yard of dredge material, and completing the fill of 84 acres authorized in a permit issued in 1998. The U.S. Army Corps of Engineers, Mobile District (Corps) has initiated consultation for potential adverse impacts to essential fish habitat (EFH). As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, NMFS provides the following comments and recommendations pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Project Area

Prior to 1991, the port facility occupied 286 acres in Mississippi Sound. In 1991, a 29-acre fill expansion was permitted (MS88-00954-L) for the purpose of accommodating existing and anticipated future container throughput for the next 50 years. In this configuration, the port covered 315 acres and supported break-bulk, bulk, container, commercial fishing, and gaming facilities (MSPA Gulfport Strategic Plan 1994). The permit issued in 1998 (MS96-02828-U) authorized filling of an additional 84 acres and dredging of 15 acres of Mississippi Sound for container and break-bulk handling and storage, and allowed relocation of the small craft harbor channel. The purpose of the 84-acre expansion was to provide rail interface for intermodal customers. This facility has not been constructed but remains a critical component of the 84-acre expansion. Sixty acres of the 84-acre fill are currently under construction and expected to be completed by November 2010. The remaining 24 acres will be filled shortly thereafter. When this area is filled, the MSPA property will occupy a total area of 399 acres of Mississippi Sound, a 26.6 percent increase over the 2005 footprint. The proposal now under consideration will extend the port facility out into Mississippi Sound an additional 1.5 miles.

Impacts to Essential Fish Habitat

NMFS is concerned that filling an additional 616 acres of estuarine benthic habitat and water column and dredging an additional 332 acres of shallow estuarine bottoms to depths ranging from 32 to 36 feet, with perhaps a 4-foot over dredge allowance, would adversely impact EFH and other NMFS trust resources. The shallow unvegetated areas of Mississippi Sound are productive growth sites for macro- and microphytic algae, benthic diatoms, benthic dinoflagellates, polychaete worms, crustaceans, and mollusks (Livingston 1990). These benthic flora and fauna are important sources of food for a variety of fish and invertebrates that are of commercial, recreational, and ecological importance (Armstrong 1987). These habitats also provide essential forage, cover, spawning, and nursery areas for numerous commercially and recreationally important species (Christmas 1973). In addition to the direct impacts on fishery resources and habitats, on-site monitoring (MSPA Water Quality Monitoring Program 2001) has found that water quality within the small craft harbor and in the berthing area at West Pier is significantly degraded from May through September. Poor water quality conditions further impair the ecological value of project area habitats and their support of benthic and nektonic resources of Mississippi Sound.

Mississippi Sound is designated as EFH for the following federally managed species: red drum; Spanish mackerel; white, brown, and pink shrimp; Gulf stone crab; and several shark species. Categories of EFH that would be impacted by the project include sand and mud substrate and estuarine water column. Preliminary examination of the seasonal patterns of abundance suggests that at least one of the managed species is present in Mississippi Sound at all times of the year. Detailed information on federally managed fisheries and their EFH is provided in the 2005 Generic Amendment to the Fishery Management Plans for the Gulf of Mexico, prepared by the Gulf of Mexico Fishery Management Council (GMFMC). In addition to EFH designated for federally managed species, Mississippi Sound provides nursery and foraging habitats that support both forage and economically important marine fishery species such as black drum, spotted seatrout, southern flounder, gulf menhaden, bluefish, croaker, mullet, and blue crab. These estuarine-dependent organisms serve as prey for other fisheries managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks).

Compensatory mitigation

Within the sequential mitigation process, compensatory mitigation is proposed only after water-dependent projects have undergone an alternatives analysis that results in adequate avoidance and minimization of impacts. Evidence of such an analysis has not been provided to NMFS. As proposed, this project would likely require compensatory mitigation based on the resources present at this location. The public notice describes a conceptual approach for mitigation that would include coastal habitat restoration and enhancement, creation of nearshore reefs, deployment of derelict vessels within existing fish havens, enhancement of oyster reefs, management of coastal preserves, and acquisition of new properties for inclusion in the coastal preserve program.

This conceptual approach may constitute suitable mitigation options for such a project, but a final determination would be based on the location and amount of acreage restored, protected, acquired or enhanced; likelihood of success, and the adequacy of contingency plans and adaptive management should mitigation measures fail to meet criteria for functionality.

Expanded EFH Consultation

The EFH provisions of the Magnuson-Stevens Act represent an integration of fishery management and habitat conservation by recognizing the dependence of healthy, productive fisheries on the availability of viable and diverse estuarine and marine ecosystems, with the goal of supporting the sustainable harvest of marine fisheries. Therefore, due to the size of the project and the nature and extent of probable direct and indirect impacts to EFH, NMFS requests that an expanded EFH consultation be conducted pursuant to 50 CFR Section 600.920(i).

As part of an expanded EFH consultation, NMFS recommends the Corps prepare an EFH assessment as described at 50 CFR 600.920(e). The EFH assessment must contain a description of the action; an analysis of the potential adverse effects of the action on EFH and the managed species; the federal agency's conclusions regarding the effects of the action on EFH, and proposed mitigation, if applicable. NMFS also recommends for this project the EFH assessment include additional information as appropriate, such as the results of an on-site inspection to evaluate the habitat and the site-specific effects of the project; the views of recognized experts on the habitat or species that may be affected; a review of pertinent literature and related information; an analysis of alternatives to the action, including alternatives that could avoid or minimize adverse effects on EFH.

Aquatic Resources of National Importance

Several of the marine resources identified herein that could be adversely affected by the project are considered to be of national economic importance pursuant to Section 906(e)(1) of the Water Resources Development Act of 1986 and, therefore, are designated as aquatic resources of national importance (ARNI). In accordance with Part IV, Section 3(a) of the Memorandum of Agreement between the Departments of Commerce and Army regarding Section 404(q) of the Clean Water Act, NMFS finds that placing an additional 616 acres of fill material and dredging of approximately 332 acres in Mississippi Sound may result in substantial and unacceptable impacts to ARNI.

Due to the scope of this project, an environmental impact statement (EIS) should be produced to analyze the potential impacts of the project as proposed and to present a set of feasible alternatives. An EIS should evaluate various construction alternatives beyond the 399-acre footprint as well as the no action alternative. Studies should be performed to characterize existing benthic communities within the areas to be dredged and filled, the adjacent areas and those within the existing channel and basin. Such studies would facilitate a comparative assessment of impacts and would assist in determining mitigation needs and options, if appropriate. In addition to habitat loss from the proposed expansion, water quality impacts must be thoroughly assessed. The 1998 permit incorporated mitigation measures to improve water quality in and around the port, but it is uncertain if these measures have been or are now being performed. An analysis of the results of the 1998 mitigation measures should be included in the EIS. A detailed plan addressing mitigation for unavoidable impacts should be provided.

In consideration of the significant direct impacts to estuarine habitats of Mississippi Sound, the probable indirect and cumulative impacts, the lack of information and analysis available at this time, and the need to ensure the conservation of EFH and dependent fishery resources, NMFS provides the following:

EFH Conservation Recommendations

1. The permit for filling 616 acres and excavating 332 acres of estuarine habitat in Mississippi Sound, as currently proposed, shall be denied.

2. Further consideration of any port expansion should require a thorough analysis of less environmentally damaging practicable alternatives and suitable mitigation options accomplished through the preparation of an EIS.

Please be advised the Magnuson-Stevens Act and the regulation to implement the EFH provisions (50 CFR Section 600.920) require the Corps to provide a written response to this letter. That response must be provided within 30 days and at least 10 days prior to final agency action. A preliminary response is acceptable if final action cannot be completed within 30 days. The Corps' final response must include a description of measures to be required to avoid, minimize, mitigate, or offset the adverse impacts of the activity. If the Corps' response is inconsistent with these EFH conservation recommendations, the Corps must provide an explanation of the reasons for not implementing those recommendations.

In addition, the project area lies within the known distribution and critical habitat of a federally listed species under the purview of NMFS. In accordance with the Endangered Species Act of 1973, as amended, the Corps' must review this proposal and determine whether the actions proposed may affect endangered or threatened species. Actions that may affect listed species should be reported to our Protected Resources Division at the letterhead address. If the Corps determines that the proposed activities may adversely affect any listed species, or destroy or adversely modify designated critical habitat, formal consultation must be initiated.

NMFS looks forward to working with the Corps in preparing the EIS and addressing these concerns. Please contact Mark Thompson of our Panama City Office at 904/234-5061 with questions regarding this EFH consultation.

Sincerely,

Miles M Croom

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc:
F/SER4
F/SER3
F/SER - Keys
cc: email
EPA Atlanta
FWS Jackson
MS DMR Biloxi
MS DEQ Jackson
GMFMC
GSMFC

NMFS - B Letter

UNITED STATES DEPARTMENT OF COMMERCE
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RD

JUN 03 2010 F/SER46:MT

RECEIVED

Colonel Byron G. Jorns
District Engineer, Mobile District
Regulatory Division
Department of the Army, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Colonel Jorns:

This letter is in reference to the Department of the Army public notice number SAM-2009-01768-DMY dated April 16, 2010. The applicant, Mississippi State Port Authority (MSPA), has requested a Department of the Army permit to dredge approximately 332 acres for new channel and harbor expansion and fill 700 acres of open water benthic habitat to construct new port facilities in Mississippi Sound, Harrison County, Mississippi.

The NOAA's National Marine Fisheries Service (NMFS) has determined the direct impacts to over 1,000 acres of productive fishery habitat in Mississippi Sound represent significant and unacceptable adverse threats to essential fish habitat and other living marine resources of national economic importance. By letter dated May 11, 2010 (copy enclosed), NMFS recommended Department of the Army authorization not be granted for the project as proposed and an environmental impact statement be prepared for the project. This recommendation is based on the significant direct impacts to essential fish habitat, aquatic resources of national importance, and the supporting food webs of Mississippi Sound, as well as the potential adverse impacts to water quality in Mississippi Sound. NMFS also remains concerned by the lack of detailed information provided thus far to support a thorough project impact analysis and develop a mitigation plan for unavoidable impacts to NMFS trust resources.

Pursuant to Part IV.3(b) of the 1992 Clean Water Act 404(q) Memorandum of Agreement between the Department of Commerce and the Department of the Army, I have reviewed the findings of my staff and determined the proposed work would substantially and unacceptably impact aquatic resources of national importance as well as essential fish habitat and associated living marine resources. I request the Corps of Engineers fully consider the views and recommendations of NMFS in making a final decision concerning authorization of the proposed work. I also encourage continued efforts to resolve this matter at the field level and have requested my staff to continue cooperating in any related effort to this end.

RECEIVED
JUN 10 2010
By

Thank you for your consideration of NMFS' recommendations. Should you have any questions, please contact Mr. Mark Thompson at (850) 234-5061.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

cc: F/SER4
F/SER46
GMFMC

LITERATURE CITED

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